THREE ESSAYS ON BANKING

BY

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DISSERTATION

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Economics
in the Graduate College of the
University of Illinois at Urbana-Champaign, 2018

Urbana, Illinois

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ABSTRACT

The thesis titled “Essays on Banking” is comprised of three essays on the aspects of the effects of bank-level credit boom on bank performance and the effectiveness of market discipline in an emerging market, where I compare empirical results between small and large banks.

The first essay demonstrates the effects of credit expansion on bank performance. By analyzing small and large U.S. banks over the period 1976~2013, I find evidence of over-optimistic lending by high-loan-growth banks: (i) banks with relatively high credit growth temporarily earn better returns and fewer loan losses, but eventually returns and credit soundness deteriorate in the subsequent one to three years; (ii) the degree of such deterioration is less severe for smaller banks; (iii) higher loan growth leads to higher leverage, especially for smaller banks; and (iv) the effects of loan growth on performance hold for subcategories of loans and are particularly strong for real estate loans and consumer loans. That these results are muted for smaller banks may be due to their limited sources of funding.

The second essay explores whether market discipline is effective in the emerging market, especially for small banks. By examining the relationship between bank risk measures and yield spreads in subordinated debts issued by banks in South Korea, I find that the market discipline in the debt yields does not work well. Investors of the debts issued by commercial banks are more likely to be affected by bank size or economic conditions rather than by the bank risk measures. As for local small banks, although some risk factors and economic conditions, not bank size, are significantly related to yield spreads, not all results are consistent with a single theory of market discipline.

The third essay investigates if the funding constraints of small banks are crucial to bank performance conditional on loan growth. The empirical findings suggest that the differences in loan growth as well as subsequent performance between small and large U.S. banks are in part driven by the financial constraints. The evidence indicates that when small banks have access to wholesale funding, their lending behavior and related bank performance become similar to large banks. In other words, if there is no financial constraint on small banks, they may be able to experience fast loan growth as large banks do.

ACKNOWLEDGEMENTS

I am greatly indebted to my advisor George Pennacchi for his sincere advice, guidance, and encouragement. I really appreciate his support that made it possible for me to complete this thesis. It is a privilege to have such an outstanding scholar and person as my advisor. I am deeply grateful to the other committee members such as Charles Kahn, Rustom Irani, and Ji-Hyung Lee. I was fortunate to have an opportunity to discuss with them regarding my thesis. Their insights and comments led me to a way for successful completion of this thesis. This thesis, particularly the first essay, benefited from detailed feedback by Dan Bernhardt.

I am very thankful to my friends for supporting me and sharing their experience and knowledge with me: Jason Huh, Jaemyun Lee, Seokjong Ryu, Dongwoo Kim, Kwanghyun Kim, Bongjun Kim, Rodrigo Schneider, and Jhih-Chian Wu.

In addition, I really appreciate my mentors and friends in the faith for their prayers and encouragement: Haeryong Chung, Young Cho, Hwanki Kim, Yoo-Seong Song, Ilsoon Kim, Hyeonjung Lee, Dongwan Yoo, and Unyoung Park.

Finally, I would like to give very special thanks to my family. With unconditional and limitless support and love of my beloved wife, Minkang Kwak, I was able to endure this long journey. My precious children, Soohyun and Ganghyun, have always been my delight as a breath of fresh air. My parents, Donghwan Cho and Wooyong Kim, have supported me with steadfast trust since my childhood. There would never be my present achievement without sacrifice and love of all of them. I dedicate this thesis to my family.

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Chapter 1

The Effects of Loan Growth on Bank Performance: Small versus Large Banks

Many researchers point out that the excessive credit expansions preceded financial distress and poor economic performance on the country level (e.g., Baron and Xiong (2017), Reinhart and Rogoff (2009)). Recently, Fahlenbrach et al.(FPS; 2017) have argued that high credit growth would make poor performance for individual banks within U.S. These researchers, however, have focused on large banks[1]. Since small banks are different from large banks in terms of funding, asset structure, and organization, it is not clear that the previous result would carry over the entire banking sector including small banks. In other words, it is necessary to investigate whether the excessive credit expansion would have an adverse effect on small banks as well.

This paper shows that the results for small banks are generally consistent with the results from the previous works on large banks. As with FPS, my findings show that the high loan growth banks may temporarily have more returns and less losses but that the returns and the loan soundness have substantially deteriorated over time. Because small banks are limited in the analysis of the credit growth and subsequent stock returns, I can derive my results from accounting performance.

Yet all is not similar to the previous works. This is mainly caused by the characteristics of the small banks. First, the small banks with high loan growth experience the less negative impacts than the large banks in terms of returns and loan loss provisions. Next, the small banks have a slower deterioration in the state of their loans. Finally, such differentiation can be verified by the finding that the small banks have a larger and more consistent decline in the equity capital ration (increase in the leverage) than the large banks.

[1]The large bank means the bank whose total assets are greater than $2 billion and who affects overall credit supply beyond the local level. On the other hand, the small bank means the one whose total assets are less than $2 billion.

My evidence is associated with theories of credit booms. Mian and Sufi (2010) present two plausible explanations for the causes of credit cycle: (1) the demand side followed by the productivity shock and (2) the supply side driven by various factors including financial innovation. My research is in line with shifts in the supply of credit. Yet it also indicates the shifts driven by over-optimistic expectation of banking sector, which is related to one of the ideas of Bordalo et al. (2017). Bordalo et al. (2017) show that their model based on biased expectations for future incomes can explain how credit markets overheat. In fact, my results support the hypothesis that even small banks may have the over-optimism in the quickly growing period and would experience poor outcomes over times.

My estimation approach follows the empirical methodology of Baron and Xiong (2017) and FPS. While Baron and Xiong (2017) initially employ the methodology to study the relationship between credit boom and economic performance on the country level, FPS apply it to investigate credit growth of the large banks and subsequent returns. I use the approach with time and bank fixed effects to estimate the magnitude of the small bank's performance following its loan growth. The data set for the estimation consists of U.S. banks during 1976-2013.

I first examine whether or not high loan growth predicts poor future returns on assets or equity for small banks. The tests concentrate on how much accounting returns can be explained by a bank's loan growth. The results from the regressions are qualitatively similar to those of large banks' returns on assets (ROA). There are, however, a few differences between small banks and large banks: (1) the larger the bank's size is, the more negative effects it would have on ROA and return on equity (ROE) after fast loan growth, and (2) the larger banks would decrease in their returns faster than smaller ones.

Next, I turn to the question whether the loan growth deteriorates the soundness of loans if the banks raise their loans quickly. To answer the question, I run regressions of subsequent loan loss provisions to total loans and nonperforming loans to total loans on loan growth. The findings in the tests demonstrate that the banks in the fastest growth quartile tend to have their loans be worsened significantly and quickly in comparison with the banks in the lowest growth quartile. At the same time, they show that the large banks tend to experience

worse deterioration in the soundness of loans than the small banks.

My third question is how loan growth affects the banks' leverage that is regarded as a critical factor to explain the credit cycle (Geanakoplos (2010)). Robust result is that higher loan growth would be leading to higher leverage. The leverage increase due to loan growth does not show any significant changes during three years after the formation period because it is not easy for the small banks to reduce leverage through capital expansion in the short term. Meanwhile, the bank size matters because the small banks have a much larger and more consistent increase in their leverage than the relatively large banks.

Lastly, I investigate whether my previous findings are compatible with tests for the subcategories of loans such as loans secured by real estate, commercial and industrial loans, and consumer loans. As in the analysis of total loans, even in the cases of subcategories of loans, the higher increase in the loans reveals more damage to the credit soundness. The results for loans secured by real estate and consumer loans explicitly support this argument. Meanwhile, the case of real estate loans shows differences between the results of the small banks and the large ones. The nonperforming loans secured by real estate in the large banks are early rising in comparison with the small banks. Also, as the loans grow, the deterioration of the loans in the large banks becomes even greater than that of the small banks.

My research is in line with the strand of the literature that explores whether banks made poorer loans during the credit booms. There are two approaches in the plausible explanation for the effects of the credit booms or the origin of the credit cycle. One is the macroeconomic approach, and the other is the microeconomic approach.

The macroeconomic approach focuses on the explanations for the cyclical variations and the specific economic conditions that may make the boom and the subsequent bust. This approach seeks to identify how the financial system is associated with the business cycle or credit cycle (Bernanke and Gertler (1989), Kiyotaki and Moore (1997), Borio et al. (2001)). Dell'Ariccia et al. (2017) demonstrate that low short-term interest rate by the central bank may cause banks to make more risky portfolios. In particular, the credit booms are mainly highlighted as an important risk factor in future macroeconomic outcomes (Schularick and Taylor (2012), Jordà et al. (2013), López-Salido et al. (2017), Baron and Xiong (2017)),

which are associated with the biased expectation and the credit view argument that financial crises can be seen as "credit booms gone wrong" (Kindleberger (1978), Minsky (1977)). Recently, Bordalo et al. (2017) have theoretically suggested that biased expectations lead to overreaction and neglect risk in financial markets.

On the other hand, the microeconomic approach concentrates on a specific channel to the market distress followed by credit booms through a particular financial industry or intermediary. Previous works in this approach shed light on the cause of the surge in the subprime mortgage loans as lax screening and subsequent bad outcomes (Mian and Sufi (2009), Demyanyk and Van Hemert (2009), Dell'Ariccia et al. (2012)). Some economists point out that the securitization had a crucial role in the lax screening of the loans (Keys et al. (2010), Shleifer and Vishny (2010)). In addition, Greenwood and Hanson (2013) provide an evidence that the credit quality of corporate debt issuers deteriorates during credit boom. At the individual bank level, FPS conclude that the fast loan growth leads to poor performance. Although the scope of the approach is different from the macroeconomic approach, these analyses like many works in the macroeconomic approach also show that credit booms by overoptimistic expectations make adverse effects in the strand of such behavioral finance.

My paper is mainly in line with the microeconomic approach and, especially, FPS's arguments. While FPS analyze only large banks, my paper provides the bank-level evidence of negative impacts of credit expansion including small banks. The core finding is that, regardless of the size of banks, quick loan growth predicts poor future performance.

Moreover, my results supplement the existing findings in many aspects. In the regression analysis, the paper uses new variables for the small banks such as nonperforming loans, equity capital ratio, and charge-offs. FPS focus on large banks because they use data on stock returns and analyst forecasts that are only available for publicly-traded large banks. Instead of using stock returns and analyst forecasts, I examine whether or not small banks that almost are not publicly-traded are similar to large banks in terms of accounting performance.

As an extension, I explore the effects of increases in subcategories of the banks' loans on the credit soundness. There is no research that has ever analyzed the effects of fast loan growth by each subcategorized loan at bank-level. Exceptionally, the subprime mortgage loans

are separately dealt with a topic of interest to many economists after the Great Recession. My result shows that loans secured by real estate and consumer loans demonstrate clear relationships between loan growth and deterioration in soundness. It is plausible to conjecture that banks may easily make the two types of the loans without appropriate screening. In addition, the bank size affects differences of the impact of growth of the loans. The soundness of large banks' subcategories of the loans with high growth has been more worsened than that of small banks' subcategorized loans in three years.

My paper is also associated with the researches focusing on bank size. Previous studies on small banks have mainly attempted to explain how small banks specialize their lending relationship (Berger and Udell (2002), Cole et al. (2004), Berger et al. (2005)). However, my research concentrates on how the impacts of bank-level credit expansion vary in relation to the bank's size. The evidence detects the meaningful differences depending on the size in terms of degree and quickness of credit deterioration. Thus, it is plausible to predict that small banks could not aggressively expand their loans like large banks due to their limited sources of funding. In other words, small banks make use of the soft information and then can be restrained from their proliferation to riskier lending. The conjecture is consistent with Berger et al. (2005).

My paper provides implications for banking regulations. I find evidence of over-optimistic lending by high loan growth banks during bank-level credit booms. Such a lending tends to eventually deteriorate bank performance. Thus, financial regulation needs to curb excessive loan growth due to over-optimism during an economic boom. Indeed, since the Great Recession, stronger regulations for banks (Basel III)[2] have been introduced and are in the process of being implemented. The regulations will protect banks from increasing loans procyclically and excessively. My result supports that large banks need more stringent

[2]The capital framework is strengthened to have sufficient capital buffers in times of crisis, and regulations are added to restrict excessive leverage increases. The Basel Committee agreed that the common equity ratio will increase from 2% to 4.5%, with an additional countercyclical buffer of 0 2.5% at the discretion of country supervisors. Also, banks will be required to hold a "capital conservation" buffer of an additional 2.5% of common equity, bringing the total to 7%. The Tier 1 capital requirement will increase to 6% from 4%, while the total risk-adjusted capital requirement will remain unchanged at the existing 8% level. Moreover, definitions of various forms of capital have also become more stringent. In addition, the committee introduced a minimum Tier 1 leverage ratio of 3% during the parallel run period from 1 January 2013 to 1 January 2017.

supervision than small banks. The new regime of bank regulation also includes this argument through managing systemically important financial institutions more prudently.

The paper is structured as follows. Section 1.1 describes the data used in my analysis. Section 1.2 introduces the regression methodology and presents the main results, using the loan growth of the small banks to predict their returns, soundness, and leverage. In section 1.3, I extend the analysis to the subcategories of the loans such as loans secured by real estate, C&I loans, and consumer loans. Section 1.4 provides robustness checks about the main results. Finally, Section 1.5 concludes. I also provide the last section, which reports additional details regarding data construction and additional robustness analysis.

1.1 Data

I describe the concrete information of the data in order to analyze the effects of fast loan growth on returns, loan soundness, and leverage for the small banks.

1.1.1 Sample Construction

To study the effect of fast loan growth of the small banks, I use $2 billion in total assets as a threshold to distinguish between the large banks and the small banks following FPS. Hence, a data set for my analysis consists of U.S. banks with less than $2 billion in total assets over 1976-2013 from Call Reports. To find pure loan growth, I use the Chicago Fed M&A database for obtaining information on bank mergers and acquisitions.

1.1.2 Summary Statistics

I show what characteristics the sample has as various variables (e.g., loan growth rate, the returns as ROA and ROE, indicators of credit soundness as loan loss provisions and nonperforming loan, and equity capital ratio for leverage). Table 1.1 shows sample summary statistics. Loan growth is calculated using data on total loans. One-year and three-year loan

growth refers to a bank's total loan growth from years $t-1$ and $t-3$ to year t, respectively. In addition, three-year loan growth is annualized.

To analyze the impacts of the pure loan growth, it is necessary to create a data set that does not include the influences of mergers and acquisitions. Having identified the sample banks from the database of the Federal Reserve Bank of Chicago, I obtain loan and asset data from Call Reports. Then, I calculate organic growth of the loans by subtracting the loans acquired in each period as $\frac{Total\ Loans_t - Acquired\ Loans_t}{Total\ Loans_{t-1}} - 1$, and finally use the organic growth rate.

On average, banks' loans and assets have been grown in every year. The median growth rate is 7.38% (large banks in FPS, 10.3%) at the 1-year horizon, and 8.00% (FPS, 11.8%) at the 3-year horizon. Asset growth is calculated in the same way as loan growth. The median bank has an asset growth of about 2.21% (FPS, 9.3%) per year, and a three year asset growth of 2.34% (FPS, 11%).

I use the accounting returns such as ROA and ROE since there is limited source of data for stock returns of the small banks. The year t ROA and ROE are defined as net income divided by total assets and total equity capital, respectively, multiplied by 100. Both ROA and ROE are expressed as a percentage. The median bank has an ROA of 0.97% (FPS, 0.85%). The median bank has an ROE of 10.84%.

In addition, the equity capital ratio (ECR) is selected to investigate the relationship between leverage and loan growth. It is also expressed as a percentage and is defined as total equity capital divided by total assets multiplied by 100. The median bank has an ECR of 8.72%.

Both indicators of loan loss provisions and nonperforming loans disclose the soundness of loans. They are also expressed in percentage terms. The former is calculated as loan loss provision (RIAD4230) divided by total gross loans multiplied by 100. The median bank sets aside 0.18% of gross loans as loan loss provisions each year. The latter is calculated as "nonperforming loans"[3] divided by total gross loans multiplied by 100. The median bank has

[3]"nonperforming loans" = total loans and lease financial receivables on nonaccrual basis (RCFD1403) + total loans and lease financial receivables past due 30-89 days and still accruing (RCFD1406) + total loans

1.27% of gross loans as nonperforming loans each year.

Since there are extreme values as outliers, it is necessary to reduce the impact of them in the regression analysis. Hence, I winsorize loan growth, asset growth, ROA, ROE, equity capital ratio, loan loss provisions, and nonperforming loans at the 5^{th} and 95^{th} percentile, respectively.

1.1.3 Low Growth and High Growth Banks

I investigate the small banks' performance, soundness of loans, and leverage with different growth rates in the main regressions. I construct loan growth quantiles in order to capture any nonlinear relation between loan growth and various dependent variables such as returns, lending soundness indicators, and leverage of the small banks.

Figure 1.1 shows the median three-year loan growth for two groups of banks. For each year, I split the sample by past three-year loan growth into quartiles. The solid lines correspond to the median loan growth for the banks in the lowest growth quartile, and the dashed lines plot the median loan growth for the banks in the highest growth quartile.

Several differences between the small and the large banks can be derived from the figure. First, the figure demonstrates that the fluctuation in annual loan growth of the small banks is relatively moderate while the loan growth in the large banks has fluctuated since early 1970. In particular, the large banks' growth in the high growth quartile differs from the small banks' in the nineties, which is caused by a large number of interstate bank mergers in the late nineties. However, the consolidation trend does not affect the small banks, so such change in U.S. banking sector does not make the small banks grow at those periods. Second, the small banks generally have lower median loan growth than the large banks. This is especially evident in the median three-year loan growth for low three-year loan growth quartile. According to Figure 1-(a), since the late 1970s, the median three-year loan growth for small banks in the low loan growth quartile has consistently been less than zero. On the other hand, large banks in the low loan growth quartile have positive median loan growth

and lease financial receivables past due 90 days or more and still accruing (RCFD1407)

except for a couple of short periods. Finally, median loan growth rates of every group plummet to very low levels in the Great Recession. The evidence shows that the recession negatively affects total loan markets.

1.1.4 Characteristics of the Small Banks

Prior to the analysis, it is necessary to examine the attributes of the small banks in comparison with those of the large banks that previous works dealt with. This section provides evidence that the small banks have their own characteristics, which distinguish them from the large banks.

First, I investigate the deposit asset ratio to verify whether there is a difference of funding source. I segment U.S. banks into three groups by total assets: (1) the large banks have total assets greater than $2 billion, (2) the medium banks' total assets are between $1 billion and $2 billion, and (3) the small banks have less than $1 billion in total assets. As Figure 1.2 shows, there are a few differences between the large banks and the other two groups. Both the small and the medium banks have similar median deposit ratios, but the the median value of the large banks is much lower than the others. That implies that the small and the medium banks mainly depend on deposit funding while the large banks have a variety of funding sources.

Second, I find the loan asset ratio for examining the differences in the portfolios of the large banks and the small banks. Figure 1.3 shows that the loan asset ratios were on an upward trend for all groups of banks. However, there are some differences between the large and the small-medium sized banks. The loan asset ratio of the large banks was relatively high during 1980 to 2000. The ratios of small and medium-sized banks rose steadily until the Great Recession without large amplitude, but the large banks had boom and bust cycles of the ratio roughly accompanying the business cycle. In other words, before the early 2000s, the small banks' loans to assets were not as sensitive to the business cycle as the large banks, but since then, the small banks had the similar move of the portion of loans to that of the large banks.

Third, it is necessary to check if the organizational structure of the small banks differs from that of the large banks. Berger et al. (2005) find the evidence that small banks are at a comparative advantage in evaluating small firms' projects via soft information. In contrast, large banks have a strength to lend large companies by the rating system based on verifiable information as accounting records. Thus, the small banks have an organizational feature that differentiates them from the large banks. In this way the small banks have many different characteristics than the large banks. Therefore, it is meaningful to examine whether fast loan growth is followed by poor performance for "small" banks by comparing the results in FPS with mine.

1.2 Empirical Results

1.2.1 Regression Methodology

My estimation approach follows a panel regression with fixed effects model by Baron and Xiong (2017) and FPS. While Baron and Xiong (2017) initially apply this approach to the relationship between credit boom and economic performance on the country level, FPS investigate credit growth of the large banks and subsequent returns through the methodology. I use the approach with time and bank fixed effects to estimate the magnitude of the small banks' accounting returns, credit soundness subsequent, and leverage to its loan growth.

The regression equation is as follows:

$$r_{i,t+k} = \beta_2 \times I_{l_{i,t} \in Q_{2,t}} + \beta_3 \times I_{l_{i,t} \in Q_{3,t}} + \beta_4 \times I_{l_{i,t} \in Q_{4,t}} + \delta_t + \varepsilon_{i,t} \qquad (1)$$

$$r_{i,t+k} = \alpha_i + \beta_2 \times I_{l_{i,t} \in Q_{2,t}} + \beta_3 \times I_{l_{i,t} \in Q_{3,t}} + \beta_4 \times I_{l_{i,t} \in Q_{4,t}} + \delta_t + \varepsilon_{i,t} \qquad (2)$$

where $r_{i,t+k}$ is the k-year ahead accounting return (e.g. ROA, ROE) or the other indicators of bank i (loan loss provisions, nonperforming loans, equity capital ratios, etc.), $l_{i,t}$ is the one- or three-year loan growth of bank i in year t, $Q_{j,t}$ is j^{th} loan growth quartile of all sample banks in year t, $I_{l_{i,t} \in Q_{j,t}}$ is an indicator variable equal to 1 if $l_{i,t}$ is in the $Q_{j,t}$ in year t, and zero otherwise. The difference between (1) and (2) is that equation (2) contains bank fixed effects α_i. I run regressions for subsequent 1-year, 2-year, and 3-year returns or the other

indicators, and estimate identical regressions for one- and three-year loan growth.

My results of the analysis briefly demonstrate that even small banks with fast loan growth would experience poor returns and quick deterioration of loans' soundness. However, the larger the bank's size is, the more negative and quicker impacts they would have on returns and soundness of loans. It is also evident that higher loan growth leads to higher leverage, but the sharp leverage expansion is not maintained for a long time. In the case of leverage, the small banks have a much larger and more consistent increase in their leverage than the large banks. More specific analysis results are discussed in the following sections.

1.2.2 Loan Growth and Returns

In this section, I examine whether high loan growth predicts poor future returns on assets or equity for small banks. The tests concentrate on how much accounting returns can be explained by a bank's loan growth. Table 1.2 to Table 1.5 present the results about the relationship between the loan growth and the accounting returns as ROA and ROE.

To begin with, the results related to ROA suggest that one- and two-year prior high loan growth have positive impacts on ROA. In Table 1.2 and 1.3, the banks in second to fourth growth quantiles show the more profitable conditions than banks in the lowest quartile by two years after the formation period. In the first year, the banks with highest loan growth get the most returns on assets with the bank fixed effects (0.12% by three-year loan growth and 0.19% by one-year loan growth).

However, the impacts of loan growth on ROA reverse three years after the formation period. At the third year, the returns on assets in the banks of three quartiles become lower than the banks in the bottom quartile. In detail, 6^{th} columns in Table 1.2 and Table 1.3 demonstrate that in years in which banks are in the highest growth quartile in comparison with years in which they are in the lowest quartile, their subsequent returns are 0.03% (one-year loan growth) and 0.08% (three-year loan growth) lower.

Certainly, the bank's size matters in the ROA case. In the three-year loan growth, my results are qualitatively similar to the results of FPS that dealt with the large banks. However,

the larger the bank's size is, the more negative effects as well as the quicker plunge they would have on ROA after fast loan growth. FPS show that ROA of the large banks after two years become lower than ROA of the banks in the base quantile of the loan growth. Also, the large banks have larger drop in ROA than the small banks with bank fixed effects (e.g., -0.17% of the large banks in high loan growth vs. -0.08% of the small banks).

Regarding the return on equity, the similar conclusion results from the analysis of the loan growth. Table 1.4 and 1.5 suggest that the ROE is hurt only in the three-year prior loan growth, particularly with bank-fixed effects. The banks with highest growth obtain the most returns on equity at the one-year and two-year horizons with the bank fixed effects. On the contrary, high loan growth has a significantly negative correlation with subsequent returns at the three-year horizon. At the horizon of the three-year loan growth case, the ROE of the banks in the highest growth falls to their greatest extent; that is, it even reverses the trend.

In this regard, the bank's size makes difference of the impacts on ROE. The banks with greater than $1 billion of total assets demonstrate that their returns on equity have deteriorated faster and deeper than the smaller banks. I segment the sample into two subgroups to see how loan growth takes effects on the ROE, depending on the size of the bank. The cutoff is $1 billion in total assets. Three quartiles of three-year loan growth in the larger banks with bank-fixed effects have lower returns than the base quartile in the larger banks after two years while same phenomenon occurs in the smaller banks after three years. When compared for same quartiles of loan growth with bank-fixed effects, the returns on equity of larger banks have lower than those of smaller banks. The larger bank seems to be more sensitive to adverse effects of high loan growth on their returns than the smaller banks.

These results imply that large banks that have better access to wholesale loans and so grow very fast could face a more severe plunge of their accounting returns than small banks. In other words, the screening might not work appropriately for the banks with the huge loan growth.

1.2.3 Loan Growth and Soundness of Loans

I have analyzed how loan growth affects the returns in the small banks. Now I examine whether the small banks are aware that they were making riskier loans when they grew quickly. I take into account indicators such as loan loss provisions and nonperforming loans [4] to reflect the credit soundness.

My evidences in Table 1.6 and 1.7 show that loan loss provisions in the high loan growth banks eventually increase over three years. Table 1.6 shows that one-year prior growth eventually leads to worsened loan loss provisions. Even though the impact of loan growth is not clear in the first year $(t+1)$ from the formation year (t), I observe, the banks with high loan growth have significantly higher loan loss provisions over the three post-formation years. The robust results support the idea that the banks with higher loan growth tend to hold the more loan loss provisions after two years. Also, Table 1.7 demonstrates that the loan loss provisions in every quartile have increased over time.

In addition, Table 1.7 shows the difference between the large banks and the small banks in terms of the change of loan loss provisions by loan growth. First, loans loss provisions of the small banks grow earlier than those of the large banks. My results from the small banks present that three-year loan growth increases loan loss provisions from $t+1$, which is different from the results of the large banks by FPS. However, the results of FPS show that the large banks with high growth have lower loan loss provisions than those with low growth by $t+1$. Second, the large banks have more increasing on loan loss provisions than the small banks at three-year horizon (e.g., the highest loan growth case of three-year growth with bank fixed effects: 0.23% of the large banks vs. 0.16% of the small banks). That means the large banks with high growth might temporarily reduce loan loss provisions, but they would deteriorate the soundness of loans over time more harshly than the small banks.

Next, I examine the effects of loan growth on nonperforming loans. The results in one-year loan growth (Table 1.8) prove that banks with high loan growth tend to hold more

[4] I define loan loss provisions as loan loss provisions in the balance sheet divided by total loans outstanding and define nonperforming loans as loans that are past due at least 90 days or on nonaccrual basis divided by total gross loans and multiplied by 100.

nonperforming loans in three years after the formation period than banks with low loan growth. That is consistent with the other previous results about loan loss provisions.

Table 1.9 shows the estimates of bank-quartiles via three-year loan growth on the nonperforming loans. The results prove for the hypothesis that high growth banks have significantly more nonperforming loans than low growth banks. In two or three years, the nonperforming loans are skyrocketing over all groups in comparison with the base group with the lowest growth. In particular, the total increase in nonperforming loans for the highest growth quartile in comparison with the lowest quartile is 0.28% without bank fixed effect or 0.34% with bank fixed effect. The increase in nonperforming loans is monotonic in the amount of loan growth.

The above results imply that the soundness of the banks significantly and quickly deteriorates when their loans grow quickly. In other words, high growth banks made riskier loans without fully charging for the greater risk. Even though the small banks experience less deterioration in the loan soundness than the large banks, my results are generally compatible with the FPS analysis.

1.2.4 Loan Growth and Leverages

Finally, I deal with the question how loan growth affects the banks' leverage that is regarded as a critical factor to explain the credit cycle (Geanakoplos (2010)). I analyze the relationship between the banks' leverages and loan growth. Because the equity capital ratio is an indicator for measuring a bank's leverage, I regress the ratios on loan growth.

Robust results demonstrate that higher loan growth would lead to higher leverage. Table 1.10 shows that one-year prior loan growth always decreases the equity capital ratio. In particular, the banks with higher loan growth have more negative correlation to the equity capital ratio than ones with lower loan growth. The evidence implies that the leverage of high growth banks increases more than that of low growth banks and this phenomenon consistently lasts for three years.

These results can be found in Table 1.11, the case of the three-year loan growth. The

extent of the effects is different, but the overall characteristics are very similar. While the leverages of three bank-quartiles rise in the early period after the increase in the loans, changes of the leverages are not large over the three years. In other words, the leverage increase due to loan growth does not show any significant changes in the short term because it is not easy for the small banks to reduce leverage through capital expansion.

The size of the banks is also an important factor in the analysis. I segment the sample into two subgroups to see how loan growth takes effects on the equity capital ratio as in the previous analysis. The cutoff is $1 billion in total assets as well. Regardless of the one- or three-year loan growth, the smaller banks with total assets under $1 billion across three quartiles have a much larger and more consistent decline in the capital ratio (higher leverage) than the larger banks. It supports the inference that the loan growth of the smaller banks mainly comes from deposit growth rather than equity growth because of the restriction to funding via the capital market as is shown in Figure 1.2.

1.2.5 Impacts of Asset Growth

As an extension, I examine the impacts of asset growth on various performance indicators of the small banks. The impacts may be expected to have a similar pattern to the effects of the increase in loans due to the large share of loans in assets (more than 50%). Nevertheless, it needs to verify whether the portion of the non-loan asset growth has incremental predictive power for future performance.

In fact, the effect of asset growth on the banks' performance is generally similar to the effects of loan growth, but its magnitude is somewhat limited compared to that of loan growth. First, it is sure that the returns of the small banks with high asset growth tend to deteriorate over time, but not so much as those of the small banks with high loan growth. For example, ROA with three-year asset growth (e.g., -0.04% in quartile 4 at three year horizon) is not hurt as much as with pure loan growth (eg. -0.08% in quartile 4 at three year horizon).

Second, the deterioration in the loan soundness due to the steep increase in the assets is similar to that of the banks' returns. Loan loss provisions of the banks with fast asset growth

have increased not so much as those of the banks with high loan growth. The results of the nonperforming loans are similar to those of loan loss provisions. Even though both loan and asset growth cases show the adverse effects of the high growth on the nonperforming loans, the increase in the nonperforming loans of the asset growth is smaller than that of the banks with high loan growth.

Finally, the banks with rapidly growing assets have certain characteristics in relation to the leverage in comparison with the other banks. The leverage of the banks with low asset growth would increase less than that of the banks with low loan growth. However, the leverage of the banks with high asset growth would increase relative to that of the banks with high loan growth.

Overall, the evidence supports that the asset growth hurts the banks' performance as much as loan growth. In other words, the non-loan assets do not make counter impacts on the banks' performance against the effects of high loan growth.

1.3 Impacts of Growth of Subcategories of Loans

The next step is to investigate if the results of the previous analyses are still valid in the subcategories of the loans such as loans secured by real estates, commercial and industrial loans, and consumer loans. To achieve this purpose, I run regressions on subcategorized loans of the banks by using the same methodology as I do in the previous sections. I use Call Reports data to find information on subcategories of loans and indicators of soundness on each loan. The loans secured by real estates (RCON1410) as well as the commercial and industrial loans (RCON1600) are the outstanding values in the Reports. The consumer loans are defined as loans to individuals for household, family, and other personal expenditures (RCON1975).

Since it is difficult to identify the returns from each subcategory of the loans, I focus on the impacts of each loan growth on the credit soundness. To measure the credit soundness, I use such indicators as the proportion of the nonperforming loans and the charge-off ratio that are expressed as a percentage. The nonperforming loans (NPL) is calculated by dividing

the "nonperforming loans" in each subcategory by the subcategorized loans and multiplying by 100. The "nonperforming loans" are identically defined as before. The other indicator, charge-off ratio, means the amount of charge-off in each subcategory that is divided by the subcategorized loans and multiplied by 100.

First, I analyze the impacts of each growth of subcategories of the credit soundness to all banks without separating them in terms of bank size. In this part, I find the properties of the credit soundness in specific subcategorized loans when the loans have grown fast. Next, I explore whether the effects of loan growth vary depending on the size of the bank by the same cutoff ($2 billion in total assets) as before. I have paid particular attention to verifying the differences of the effects between the small and large banks in terms of the subcategory of the loans.

1.3.1 Tests for All Banks

Now I investigate the impacts of subcategorized loan growth on the credit soundness in all banks. According to the results, it is evident that the faster the loans grow, the worse the soundness of the loans goes. In particular, NPL in the loans secured by real estate strongly have such a tendency. The case of NPL in the consumer loans demonstrates that the quality of the loans deteriorates more quickly and largely than the other loans. It is plausible to argue that loans secured by real estate and consumer loans are relatively sensitive to over-optimistic lending.

Loans Secured by Real Estate

First, I examine the case of loans secured by real estate. My results overall demonstrate that the faster the loans grow, the more the loans subsequently deteriorate. The analysis of the NPL with bank-fixed effects well supports the hypothesis well since one year after the loan expansion. Table 1.12 shows the NPL have increased since the loan growth and the proportion with high growth is consistently higher than that with low growth with bank-fixed effect.

The charge-off ratio shows slightly different results. The adverse impacts of high growth of the loans are not as obvious as the case of NPL. The charge-off ratio temporarily declines following an increase in the loans. However, the proportion generally shows the banks in each quartile of the loan growth are increasing the charge-off ratio over time.

Commercial and Industrial Loans

In this section, I deal with the commercial and industrial (C&I) loans. The empirical tests for C&I loans do not yield significant results like the case of the loans secured by real estate. Nonetheless, Table 1.14 and 1.15 present that the magnitude of the impact of an increase in C&I loans is the largest in comparison with the other lending if the statistical significance is not critically considered.

The NPL are dramatically worsened in one year from the formation period. Yet, as time goes by, the NPL are relatively weakened compared to other loans. Nonetheless, it can be seen that the NPL are the highest when a bank is in the highest quartile of the loan growth in two or three years after the formation period.

The charge-off ratio temporarily decreases at the first year and is in a negative relationship with the loan growth. Table 15 shows that the ratio with bank-fixed effects at the three-year horizon relatively increases more like the case of the NPL in comparison with the other disaggregated loans.

Consumer Loans

Lastly, I investigate the case of the consumer loans. The robust results demonstrate that the deterioration of the credit soundness of the consumer loans due to the surge in the loans is relatively rapid and clear. The NPL of the banks with high loan growth are consistently higher at any time horizon than those of the banks with low growth with bank-fixed effect.

The charge-off ratio shows that an increase in the ratio of the banks with high loan growth is seen in two years from the formation period even though the magnitude of the coefficients are small. As such, it can be inferred that the consumer loans are quickly affected by an

increase in lending.

1.3.2 Tests for the Small versus the Large Banks

In this section, I examine how the increase in each subcategory of the loans varies in relation to the size of banks. In the previous analyses of total loans, the small banks have both similarities and differences from the large banks in terms of the empirical tests for the impacts of loan growth. Hence, I try to find out whether the cases of each category of loans are similar to the previous results from the tests on total loans.

The empirical tests in this section are conducted in the same way as tests on the disaggregated loans for all banks, and only the analysis target is changed to the small or the large banks. As in the analyses of total loans, even in the cases of the subcategories of the loans, the higher increase in the loans brings more damage to the credit soundness.

Yet, there are differences between the small and the large banks. For example, the differences are the timing at which the soundness is worsened and the magnitude of such negative impacts. The soundness of real estate loans in the large banks is more largely hurt by the high loan growth. However, in the case of consumer loans, the small banks show the relatively robust results of the adverse impacts of fast loan growth. These results can be attributed to the differences in the number of observations and the different composition of the loans between the small and large banks.

Loans Secured by Real Estate

First, I demonstrate the test results of the loans secured by real estate. It is observed that the rapid growth in the loans of the small banks leads to increases in their NPL portion with bank-fixed effect after one year.

The case of the large banks shows the similar results. However, the NPL of the large banks with high loan growth are quickly worsened in comparison with the small banks. For example, at the one-year and two-year horizon, large banks in the highest growth quartile have 0.029% and 0.033% higher NPL ratios respectively than the banks in the lowest growth

quartile, but small banks in the highest growth quartile have 0.013% and 0.024% respectively than ones in the lowest quartile.

The charge-off ratio in the loans of both the small and the large banks temporarily decline. However, at three-year horizon, the charge-off ratio of the banks with high loan growth is higher than those with low loan growth regardless of the banks' size. There is a difference between the small and large banks. As the loans fast grow, the deterioration of the credit soundness in the large banks becomes even greater than in the small banks.

Commercial and Industrial Loans

Next, I analyze the case of C&I loans. In the small banks, the banks with high loan growth hold the NPL more than those with low loan growth. Moreover, the high C&I loan growth takes effects on the NPL at earlier times, but the degree of the deterioration is gradually weakened over time.

In the large banks, there are not many significant results. The rough results show that the large banks with fast loan growth have larger NPL than ones in the baseline over time, which is different from the case of the small banks.

Regardless of the banks' size, the banks with fast C&I loan growth tend to decrease the proportion of the charge-off until two years after the formation period. The charge-off ratio increases more with bank-fixed effect after three years than any other subcategories of the loans.

Consumer Loans

Finally, I deal with the case of consumer loans. The robust results in the small banks with bank-fixed effect suggest that the banks with high loan growth would experience deterioration in credit soundness even after one year from the formation period. In contrast, there are not significant results and there is not a robust tendency from the large banks' data.

The analysis from the charge-off data provides the similar results from both the large and the small banks. The banks that grow fast in the consumer loans have slightly higher

charge-off levels than banks with low growth.

1.4 Robustness

I present some robustness checks in this section. First, I provide the evidence that the predicted performance subsequent to loan growth remains poor even though the recession periods are excluded. Second, I show that the main results hold on the case including cumulative average earnings after loan growth. Finally, I show that the banks with high growth of subcategorized loans would experience lower returns than those with low growth as well.

1.4.1 Interact with State of Economy

My finding suggests that high loan growth would lead to poor performance. Nonetheless, it is likely that even a loan to a borrower with creditworthiness could be worsened due to an economic recession. Hence, I repeat the previous analysis but remove recession periods by the NBER indicators.

The results show that there is no critical change from the existing results covering all business cycles over 1976-2013. In other words, the evidence supports the idea that high loan growth predicts poor performance and the effect of economic downturn is limited.

Loan growth and returns : The evidence provided by Table 30 is overall compatible with those by previous tests. In addition, I find that banks with high loan growth (third and fourth growth quartiles) excluding recession years have slightly less decrease in ROA and ROE after two years.

Loan growth and credit soundness : I also find that the general trend in Table 31 of credit soundness is similar to the existing results. The results from loan loss provisions show somewhat less increases than those of tests for all periods in the third and fourth quartiles of loan growth.

Loan growth and Leverage : There is not a crucial difference between these results and

previous results including recession periods in terms of leverage. Yet, Table 32 reports that the equity capital ratio is somewhat more decreased in every three quartile of loan growth in comparison with the ratio in the main results.

1.4.2 Cumulative Effects of Loan Growth

In the main tests, dependent variables reflecting point-in-time performance are measured at one-, two-, and three-year horizon after the formation period. However, the tests do not explain how high loan growth takes effects on the cumulative average performance over the three years from the formation period. Thus, I investigate how high loan growth takes effects on cumulative performance.

For this, I use variables for cumulative performance variable as the dependent variable. The variables are calculated by aggregating earnings over the future three years divided by average total assets or average equity capital over the future three years. Then, I repeat the empirical tests on the new variables as dependent variables.

The results are qualitatively similar to those of point-in-time analysis; that is, there is no significant change of the trend over time or across loan growth quartiles. Nonetheless, the magnitude of impacts are different from those at the three-year horizon. Table 1.33 shows that the cumulative ROA is less reduced than the ROA at the three-year horizon. On the contrary, the cumulative loan loss provisions are relatively increased in comparison with the loan loss provisions at three-year horizon.

1.4.3 Subcategorized Loans and Returns

In the previous tests, I run regressions on disaggregated loans focusing on the effects of each loan growth on the credit soundness of the loans. However, the results do not verify that banks with fast growth of a specific subcategory of the loans would have poor earnings. Therefore, I examine how the banks with high growth of specific subcategorized loans would have poor earnings in the future. Since it is difficult to segment their earnings by loan types, I analyze if the banks with higher growth of each disaggregated loan would hold lower earnings

after two or three years.

The evidence suggests that the banks with high increase in real estate loans and consumer loans have relatively limited deterioration of ROA or ROE in comparison with those of total loan growth over time. On the contrary, the banks with high C&I loan growth show early and large worsening in their earnings.

Loans secured by real estate : Table 1.34 shows that the banks with high growth of real estate loans have a similar pattern to the case of total loans over time. Nonetheless, the banks with high growth of real estate loans have less effects on the earning ratios as ROA than those with high growth of total loans.

Commercial and industrial loans : Table 1.35 demonstrates that the banks with high growth of the loans would experience decreases in the earnings quickly and large in comparison with the case of total loans.

Consumer loans : Table 1.36 does not provide a clear deterioration of earnings following the growth of consumer loans. Even though the banks in the highest growth quartile hold significantly lower ROA, 0.01% (0.08% of total loans) than those in lowest quartile, the negative impacts on ROA and ROE are not clearly affected in terms of the loan growth.

These results lead to additional conjectures about the high growth of disaggregated loans and subsequent lower returns. The results of the main tests show that the increases in real estate loans and consumer loans lead to the deterioration of the soundness, but in case of C&I loans such relationship is not clear. However, I find different results from this robust test. These results show that banks with fast growth of C&I loans would hold lower earnings in the future while banks with fast growth of the other loans are not clearly predicted to have lower earnings.

1.5 Discussion and Conclusion

The excessive credit expansion has played a central role in the historical financial distress. Many researchers have suggested that such a surge in lending is due to overoptimism.

Especially since the Great Recession, there have been many studies supporting the idea, and my paper is also in agreement with it. My evidence does not explain aggregate or even regional economic activity that the leading papers dealt with but focuses on the bank-level performance.

My paper illustrates that bank-level surge in lending can result in detrimental effects on banks' returns and credit soundness in the near future. In particular, my evidence is related to the small banks that have different characteristics from the large banks that FPS have already dealt with. I find the small banks face less harmful performance, slower deterioration of credit soundness, and higher leverage following fast loan growth than the large banks. It is remarkable that the conditions of real estate loans in the large banks have been worsened enormously and quickly in comparison with those in the small banks by high growth of the loans.

Previous works based on behavior finance emphasize biased expectations for borrowers' creditworthiness or their collateral. My analysis finds poor outcomes of the biased expectations by banks in addition to the existing results. If we are to understand the negative effects of bank-level credit booms, we will have to appreciate the potential for the banks' subsequent distress by the credit booms. Therefore, banking regulators need to remove such risk from the banking sector by thoroughly implementing the new regulations (Basel III) for preventing excessive credit expansions at individual bank level. In addition, the regulators will be able to effectively achieve the goal by focusing on preventing the adverse effects of large banks' surge in loans over smaller banks.

In future research, it would be helpful to validate whether the new regulations for banks work well in restraining banks from aggressively lending. The present time is a transition period for implementing the Basel III that will become fully effective by January 2019. Since the new international regime was agreed in the Basel Committee, it is possible to examine whether there are significant changes in banks' performance by loan growth.

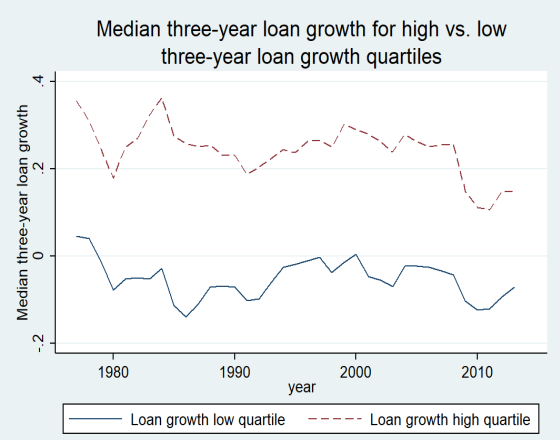
In addition, it would be interesting to examine how credit contraction takes effects on banks' performance or credit soundness. In other words, a possible research question would be whether the opposite over-reaction or overpessimism could be applied to a bank-level

loan. It is plausible to suppose that banks might be reluctant to lend promising borrowers even though they are able to bring profits to bank. For policymakers, the government based guarantee would be necessary to restore the credibility for borrowers if the additional evidence is supportive of the hypothesis. This task is left for next turn.

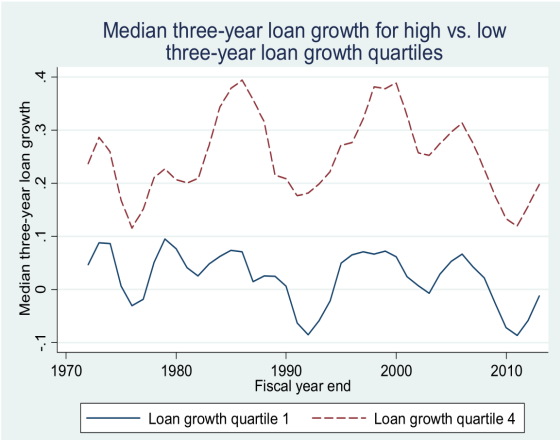
1.6 Figures and Tables

1.6.1 Low Growth and High Growth Banks

Figure 1.1: Median Three-year Loan Growth



(a) Small banks

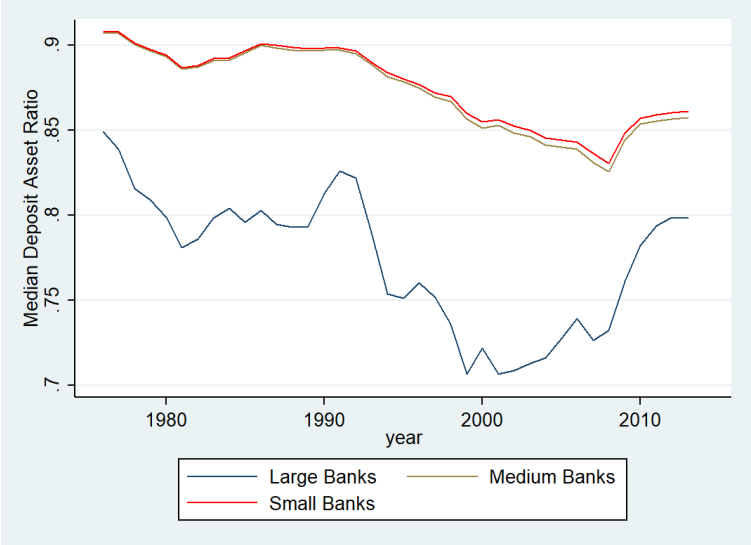


(b) Large banks

Notes. The cutoff between large and small banks is $2 billion of bank's total assets. The graph (b) is captured from Figure 1 of FPS. The solid lines in both graphs show the median three-year loan growth rate in the lowest quartile of loan growth. The dashed lines show the median three-year loan growth rate for banks in the highest quartile. While observations in (a) cover over 1976-2013, observations in (b) cover 1972-2013.

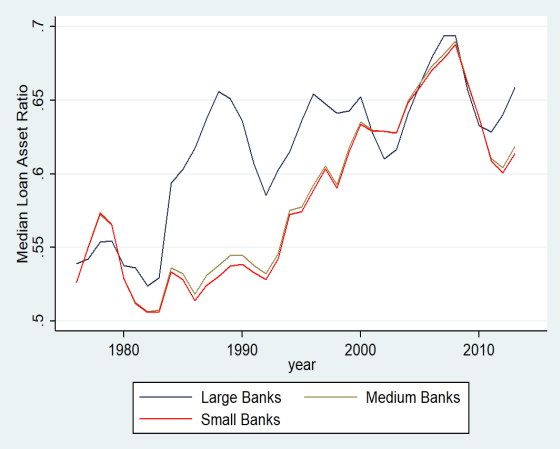
1.6.2 Characteristics of Small Banks

Figure 1.2: Deposit Asset Ratio

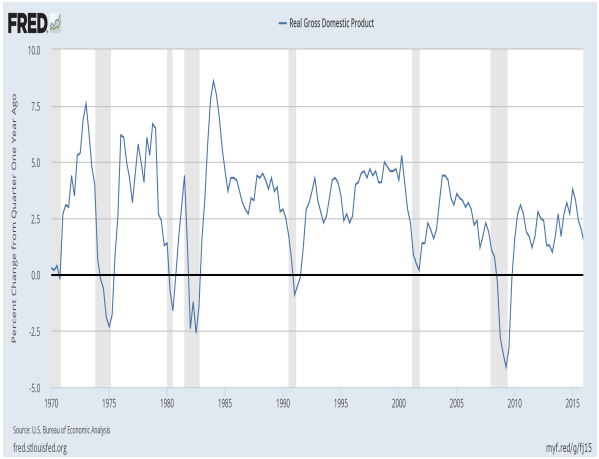


Notes. The deposit asset ratio is defined as total deposits divided by total assets. Three classes of banks are categorized as follows: (1) large banks have greater total assets that $2 billion, (2) medium banks' total assets are between $1 billion and $2 billion, (3) the small banks have less than $1 billion in total assets. Observations are annually over the sample of 1976-2013.

Figure 1.3: Weight of Loans and Business Cycle



(a) Loan Asset Ratio



(b) US Real GDP Percent change

Notes. The loan asset ratio is defined as total gross loans divided by total assets. Observations in the graph (a) are annually over the sample of 1976-2013. The graph (b) reports US real GDP percent change using the FRED. The observations are quarterly U.S. data over 1970-2016.

1.6.3 Tables of Results from Total Loans

Sample

I construct a panel data set with annual observations from 1976 to 2013. Summary statistics are reported for returns on assets (ROA), returns on equity (ROE), as well as equity capital ratio, defined as total equity capital divided by total assets, respectively, and multiplied by 100. In addition, both loan loss provisions and nonperforming loans are divided by total gross loans and then multiplied by 100. All statistics are pooled across banks and time.

Table 1.1: Summary Statistics

	obs.	Mean	St.Dev	Min.	25^{th} pec.	Median	75^{th} pec.	Max.
1yr. loan growth	385,915	0.7604	107.04	-2,231.2	-0.0028	0.0738	0.1654	52,297
3yr. loan growth	343,383	1.0934	195.91	-132.37	0.0178	0.0800	0.1640	22,448
1yr. asset growth	385,915	0.0596	0.6899	-9.2804	-0.0251	0.0221	0.0804	290.51
3yr. asset growth	343,239	0.0655	0.8397	-311.09	-0.0123	0.0234	0.0747	227.61
ROA (%)	404,908	0.7961	1.9717	-155.95	0.5936	0.9687	1.2960	494.99
ROE (%)	404,902	7.0432	554.57	-181,230	6.4699	10.835	14.520	194,100
Equity captial ratio (%)	404,908	9.7574	5.2926	-47.942	7.3914	8.7249	10.690	100
Loan loss provisions (%)	404,896	0.3961	1.1179	-32.282	0.0567	0.1791	0.4015	404.43
Nonperforming loans (%)	94,231	1.8985	2.2838	0	0.5496	1.2673	2.4290	50.646

Loan Growth and Returns

The tables report estimates from the panel regression with fixed effects specified in equations (1) and (2) for ROA of the small banks in subsequent one, two, and three years. In Table 1.2, the banks are sorted into quartiles based on loan growth during the previous one year. In Table 1.3, the banks are sorted into quartiles based on loan growth during the previous three years. Indicator variables representing each quartile are included in the regression with the lowest growth quartile forming the base group. Numbers in parentheses are t-statistics. *, **, and *** denote statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.2: One-year loan growth and return on assets

variable	$ROA_{t+1}(1)$	$ROA_{t+1}(2)$	$ROA_{t+2}(1)$	$ROA_{t+2}(2)$	$ROA_{t+3}(1)$	$ROA_{t+3}(2)$
Loan growh	0.1930***	0.1138***	0.1091***	0.0249***	0.0654***	-0.0189***
quartile 2	(65.14)	(43.61)	(36.25)	(9.26)	(21.64)	(-6.93)
Loan growh	0.2395***	0.1670***	0.1296***	0.0482***	0.0625***	-0.0221***
quartile 3	(80.86)	(63.70)	(43.07)	(17.83)	(20.70)	(-8.07)
Loan growh	0.1212***	0.1937***	0.0017	0.0579***	-0.0749***	-0.0302***
quartile 4	(40.89)	(72.40)	(0.55)	(21.01)	(-24.78)	(-10.81)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	383,299	383,299	383,099	383,099	383,040	383,040
R-squared	0.093	0.103	0.082	0.087	0.075	0.076

Table 1.3: Three-year loan growth and return on assets

variable	$ROA_{t+1}(1)$	$ROA_{t+1}(2)$	$ROA_{t+2}(1)$	$ROA_{t+2}(2)$	$ROA_{t+3}(1)$	$ROA_{t+3}(2)$
Loan growh	0.1381***	0.0548***	0.0812***	-0.0092**	0.0558***	-0.0353***
quartile 2	(43.87)	(19.38)	(25.44)	(-3.20)	(17.53)	(-12.19)
Loan growh	0.1658***	0.0941***	0.0771***	-0.0078**	0.0310***	-0.0579***
quartile 3	(52.66)	(32.78)	(24.15)	(-2.67)	(9.74)	(-19.69)
Loan growh	0.0625***	0.1208***	-0.0473***	-0.0060*	-0.1101***	-0.0797***
quartile 4	(19.85)	(40.41)	(-14.80)	(-1.96)	(-34.56)	(-26.03)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	341,584	341,584	341,276	341,276	341,127	341,127
R-squared	0.083	0.093	0.075	0.078	0.073	0.071

The following tables report estimates from the panel regression with fixed effects specified in equations (1) and (2) for ROE in subsequent one, two, and three years. In Table 1.4, the banks are sorted into quartiles based on loan growth during the previous one year. In Table 1.5, the banks are sorted into quartiles based on loan growth during the previous three years. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.4: One-year loan growth and return on equity

variable	$ROE_{t+1}(1)$	$ROE_{t+1}(2)$	$ROE_{t+2}(1)$	$ROE_{t+2}(2)$	$ROE_{t+3}(1)$	$ROE_{t+3}(2)$
Loan growh	2.066***	1.216***	1.168***	0.279***	0.684***	-0.195***
quartile 2	(65.66)	(42.72)	(36.47)	(9.53)	(21.22)	(-6.57)
Loan growh	2.880***	1.972***	1.670***	0.681***	0.907***	-0.106***
quartile 3	(91.56)	(69.00)	(52.16)	(23.15)	(28.12)	(-3.57)
Loan growh	2.033***	2.448***	0.7475***	0.982***	-0.134***	-0.016
quartile 4	(64.58)	(83.94)	(23.33)	(32.73)	(-4.15)	(-0.53)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	383,293	383,293	383,093	383,093	383,034	383,034
R-squared	0.105	0.101	0.086	0.078	0.073	0.063

Table 1.5: Three-year loan growth and return on equity

variable	$ROE_{t+1}(1)$	$ROE_{t+1}(2)$	$ROE_{t+2}(1)$	$ROE_{t+2}(2)$	$ROE_{t+3}(1)$	$ROE_{t+3}(2)$
Loan growh	1.518***	0.621***	0.909***	-0.051	0.598***	-0.364***
quartile 2	(45.38)	(20.16)	(26.71)	(-1.63)	(17.54)	(-11.54)
Loan growh	2.226***	1.251***	1.235***	0.129***	0.691***	-0.450***
quartile 3	(66.56)	(40.05)	(36.30)	(4.04)	(20.28)	(-14.05)
Loan growh	1.828***	1.881***	0.554***	0.416***	-0.235***	-0.471***
quartile 4	(54.61)	(57.78)	(16.27)	(12.49)	(-6.88)	(-14.12)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	341,578	341,578	341,270	341,270	341,121	341,121
R-squared	0.089	0.087	0.071	0.064	0.063	0.054

Loan Growth and Credit Soundness

The tables report estimates from the panel regression with fixed effects specified in equations (1) and (2) for loan loss provisions divided by total gross loans and multiplied by 100 in subsequent one, two, and three years. In Table 1.6, the banks are sorted into quartiles based on loan growth during the previous one year. In Table 1.7, the banks are sorted into quartiles based on loan growth during the previous three years. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.6: One-year loan growth and loan loss provisions

variable	$LLP_{t+1}(1)$	$LLP_{t+1}(2)$	$LLP_{t+2}(1)$	$LLP_{t+2}(2)$	$LLP_{t+3}(1)$	$LLP_{t+3}(2)$
Loan growh	-0.0417***	-0.0126***	0.0097***	0.0399***	0.0213***	0.0497***
quartile 2	(-24.92)	(-7.96)	(5.80)	(24.93)	(12.70)	(30.83)
Loan growh	-0.0488***	-0.0285***	0.0261***	0.0508***	0.0540***	0.0785***
quartile 3	(-29.16)	(-17.86)	(15.59)	(31.59)	(32.21)	(48.49)
Loan growh	0.0012	-0.0351***	0.0890***	0.0639***	0.1203***	0.1001***
quartile 4	(0.74)	(-21.60)	(53.13)	(38.92)	(71.75)	(60.59)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	383,287	383,287	383,088	383,088	383,030	383,030
R-squared	0.117	0.127	0.112	0.122	0.107	0.120

Table 1.7: Three-year loan growth and loan loss provisions

variable	$LLP_{t+1}(1)$	$LLP_{t+1}(2)$	$LLP_{t+2}(1)$	$LLP_{t+2}(2)$	$LLP_{t+3}(1)$	$LLP_{t+3}(2)$
Loan growh	0.0062***	0.0365***	0.0349***	0.0658***	0.0402***	0.0689***
quartile 2	(3.49)	(21.23)	(19.68)	(38.30)	(22.76)	(40.04)
Loan growh	0.0248***	0.0453***	0.0780***	0.1040***	0.0916***	0.1170***
quartile 3	(13.92)	(25.97)	(44.03)	(59.69)	(51.80)	(66.95)
Loan growh	0.0890***	0.0598***	0.1503***	0.1351***	0.1673***	0.1563***
quartile 4	(49.81)	(32.92)	(84.78)	(74.42)	(94.59)	(85.90)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	341,575	341,575	341,269	341,269	341,121	341,121
R-squared	0.120	0.128	0.124	0.134	0.121	0.134

The following tables report estimates from the panel regression with fixed effects specified in equations (1) and (2) for nonperforming loans divided by total gross loans and multiplied by 100 in subsequent one, two, and three years. In Table 1.8, the banks are sorted into quartiles based on loan growth during the previous one year. In Table 1.9, the banks are sorted into quartiles based on loan growth during the previous three years. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.8: One-year loan growth and nonperforming loans

variable	$NPL_{t+1}(1)$	$NPL_{t+1}(2)$	$NPL_{t+2}(1)$	$NPL_{t+2}(2)$	$NPL_{t+3}(1)$	$NPL_{t+3}(2)$
Loan growh	-0.2554***	-0.1490***	-0.0677***	0.0176	0.0491***	0.1103***
quartile 2	(-18.38)	(-13.23)	(-4.82)	(1.55)	(3.49)	(9.61)
Loan growh	-0.4146***	-0.2844***	-0.1168***	-0.0020	0.0649***	0.1485***
quartile 3	(-29.87)	(-24.91)	(-8.34)	(-0.17)	(4.63)	(12.76)
Loan growh	-0.5625***	-0.4902***	-0.1544***	-0.0658***	0.1047***	0.1710***
quartile 4	(-40.61)	(-41.07)	(-11.06)	(-5.42)	(7.49)	(13.91)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	92,318	92,318	92,520	92,520	92,380	92,380
R-squared	0.096	0.152	0.081	0.135	0.078	0.134

Table 1.9: Three-year loan growth and nonperforming loans

variable	$NPL_{t+1}(1)$	$NPL_{t+1}(2)$	$NPL_{t+2}(1)$	$NPL_{t+2}(2)$	$NPL_{t+3}(1)$	$NPL_{t+3}(2)$
Loan growh	-0.1519***	-0.0317**	0.0047	0.1038***	0.0856***	0.1584***
quartile 2	(-10.71)	(-2.70)	(0.33)	(8.79)	(6.03)	(13.35)
Loan growh	-0.1665***	-0.0863***	0.0754***	0.1532***	0.2048***	0.2591***
quartile 3	(-11.74)	(-7.07)	(5.31)	(12.42)	(14.42)	(20.81)
Loan growh	-0.2101***	-0.1998***	0.1098***	0.1771***	0.2820***	0.3440***
quartile 4	(-14.82)	(-15.19)	(7.73)	(13.21)	(19.84)	(25.12)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	88,900	88,900	88,774	88,774	88,335	88,335
R-squared	0.081	0.134	0.079	0.133	0.080	0.134

Loan Growth and Leverage

The tables report estimates from the panel regression with fixed effects specified in equations (1) and (2) for percentage ratio of total equity capital to total assets in subsequent one, two, and three years. In Table 1.10, the banks are sorted into quartiles based on loan growth during the previous one year. In Table 1.11, the banks are sorted into quartiles based on loan growth during the previous three years. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.10: One-year loan growth and equity capital ratios

variable	$ECR_{t+1}(1)$	$ECR_{t+1}(2)$	$ECR_{t+2}(1)$	$ECR_{t+2}(2)$	$ECR_{t+3}(1)$	$ECR_{t+3}(2)$
Loan growh	-0.0879***	-0.0416***	-0.1185***	-0.0807***	-0.0976***	-0.0683***
quartile 2	(-7.43)	(-4.58)	(-9.88)	(-8.54)	(-8.08)	(-7.05)
Loan growh	-0.3049***	-0.1619***	-0.3432***	-0.2119***	-0.3359***	-0.2162***
quartile 3	(-25.79)	(-17.78)	(-28.64)	(-22.32)	(-27.81)	(-22.21)
Loan growh	-0.4778***	-0.3019***	-0.5842***	-0.4392***	-0.5760***	-0.4533***
quartile 4	(-40.38)	(-32.49)	(-48.70)	(-45.33)	(-47.64)	(-45.66)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	383,299	383,299	383,099	383,099	383,040	383,040
R-squared	0.099	0.070	0.093	0.062	0.085	0.056

Table 1.11: Three-year loan growth and equity capital ratios

variable	$ECR_{t+1}(1)$	$ECR_{t+1}(2)$	$ECR_{t+2}(1)$	$ECR_{t+2}(2)$	$ECR_{t+3}(1)$	$ECR_{t+3}(2)$
Loan growh	-0.1506***	-0.1154***	-0.1732***	-0.1432***	-0.1471***	-0.1241***
quartile 2	(-12.09)	(-12.11)	(-13.60)	(-14.22)	(-11.42)	(-11.99)
Loan growh	-0.5055***	-0.3034***	-0.5267***	-0.3379***	-0.4979***	-0.3198***
quartile 3	(-40.60)	(-31.36)	(-41.37)	(-33.07)	(-38.65)	(-30.47)
Loan growh	-0.9775***	-0.6187***	-0.9578***	-0.6747***	-0.8699***	-0.6257***
quartile 4	(-78.44)	(-61.40)	(-75.18)	(-63.40)	(-67.48)	(-57.23)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	341,584	341,584	341,276	341,276	341,127	341,127
R-squared	0.110	0.080	0.101	0.068	0.089	0.061

1.6.4 Tables of Results from Subcategorized Loans

Tests for All Banks

The tables show estimates from the panel regression with fixed effects specified in equations in the previous section for nonperforming loans and charge-offs to the loans secured by real estates. In both Table 1.12 and Table 1.13, banks are sorted into quartiles based on the loan growth during the previous three years. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.12: NPL ratio and 3-year loan growth secured by real estate

variable	$NPL(RE)_{t+1}(1)$	$NPL(RE)_{t+1}(2)$	$NPL(RE)_{t+2}(1)$	$NPL(RE)_{t+2}(2)$	$NPL(RE)_{t+3}(1)$	$NPL(RE)_{t+3}(2)$
Loan growh	-0.0117***	0.0058*	-0.0058	0.0118***	-0.0021	0.0162***
quartile 2	(-3.89)	(2.02)	(-1.91)	(4.06)	(-0.68)	(5.55)
Loan growh	-0.0266***	0.0011	-0.0192***	0.0114***	-0.0127***	0.0204***
quartile 3	(-8.83)	(0.39)	(-6.33)	(3.80)	(-4.17)	(6.75)
Loan growh	-0.0505***	0.0029	-0.0390***	0.0158***	-0.0316***	0.0254***
quartile 4	(-16.87)	(0.94)	(-12.90)	(4.95)	(-10.38)	(7.84)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	102,457	102,457	101,387	101,387	100,728	100,728
R-squared	0.018	0.016	0.018	0.016	0.019	0.017

Table 1.13: Charge-off ratio and 3-year loan growth secured by real estate

variable	Charge-off$(RE)_{t+1}(1)$	Charge-off$(RE)_{t+1}(2)$	Charge-off$(RE)_{t+2}(1)$	Charge-off$(RE)_{t+2}(2)$	Charge-off$(RE)_{t+3}(1)$	Charge-off$(RE)_{t+3}(2)$
Loan growh	-0.0912***	-0.0536***	-0.0373***	-0.0026	-0.0069	0.0220***
quartile 2	(-24.63)	(-14.88)	(-9.96)	(-0.70)	(-1.84)	(5.98)
Loan growh	-0.1111***	-0.0992***	-0.0262***	-0.0115**	0.0316***	0.0432***
quartile 3	(-30.06)	(-26.72)	(-7.02)	(-3.04)	(8.48)	(11.35)
Loan growh	-0.0915***	-0.1464***	0.0186***	-0.0242***	0.0882***	0.0515***
quartile 4	(-24.87)	(-37.32)	(5.00)	(-6.03)	(23.64)	(12.65)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	102,457	102,457	101,387	101,387	100,728	100,728
R-squared	0.193	0.237	0.182	0.222	0.182	0.221

The following tables shows estimates from the panel regression with fixed effects specified in equations in the previous section for nonperforming loans and charge-offs to the commercial and industrial loans. Banks are sorted into quartiles based on the growth of the subcategorized loans during the previous three years. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.14: NPL ratio and 3-year C&I loan growth

variable	$NPL(CI)_{t+1}(1)$	$NPL(CI)_{t+1}(2)$	$NPL(CI)_{t+2}(1)$	$NPL(CI)_{t+2}(2)$	$NPL(CI)_{t+3}(1)$	$NPL(CI)_{t+3}(2)$
Loan growh	0.0302	0.1652	0.1041	0.0828	-0.1269*	0.0409
quartile 2	(0.54)	(1.86)	(1.89)	(0.95)	(-2.31)	(0.49)
Loan growh	0.0316	0.1772*	0.1463**	0.1324	0.0354	0.1420
quartile 3	(0.57)	(1.97)	(2.66)	(1.48)	(0.65)	(1.59)
Loan growh	0.0333	0.1111	0.2162***	0.2577**	0.2522***	0.2686**
quartile 4	(0.60)	(1.16)	(3.88)	(2.66)	(4.52)	(2.65)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	15,491	15,491	15,434	15,434	15,379	15,379
R-squared	0.024	0.086	0.026	0.072	0.029	0.065

Table 1.15: Charge-off ratio and 3-year C&I loan growth

variable	Charge-off$(CI)_{t+1}(1)$	Charge-off$(CI)_{t+1}(2)$	Charge-off$(CI)_{t+2}(1)$	Charge-off$(CI)_{t+2}(2)$	Charge-off$(CI)_{t+3}(1)$	Charge-off$(CI)_{t+3}(2)$
Loan growh	-0.3784***	-0.1363***	-0.2089***	0.0620	-0.1113**	0.1470***
quartile 2	(-11.04)	(-3.96)	(-5.97)	(1.77)	(-3.15)	(4.17)
Loan growh	-0.6516***	-0.2891***	-0.3581***	0.0086	-0.1776***	0.1358***
quartile 3	(-19.56)	(-8.41)	(-10.52)	(0.25)	(-5.16)	(3.88)
Loan growh	-0.6884***	-0.4703***	-0.2870***	-0.0432	-0.0240	0.1861***
quartile 4	(-20.43)	(-13.24)	(-8.30)	(-1.20)	(-0.68)	(5.12)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	15,960	15,960	15,745	15,745	15,561	15,561
R-squared	0.129	0.105	0.107	0.091	0.104	0.094

The tables report estimates from the panel regression with fixed effects specified in equations in the previous section for nonperforming loans and charge-offs to the consumer loans. Banks are sorted into quartiles based on the consumer loans during the previous three years. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.16: NPL ratio and 3-year consumer loan growth

variable	$NPL(C)_{t+1}(1)$	$NPL(C)_{t+1}(2)$	$NPL(C)_{t+2}(1)$	$NPL(C)_{t+2}(2)$	$NPL(C)_{t+3}(1)$	$NPL(C)_{t+3}(2)$
Loan growh	0.0576***	0.0177***	0.0627***	0.0214***	0.0608***	0.0174***
quartile 2	(15.16)	(5.38)	(16.33)	(6.45)	(15.73)	(5.19)
Loan growh	0.0793***	0.0291***	0.0811***	0.0316***	0.0814***	0.0332***
quartile 3	(20.91)	(8.61)	(21.20)	(9.28)	(21.13)	(9.68)
Loan growh	0.0393***	0.0375***	0.0460***	0.0434***	0.0431***	0.0369***
quartile 4	(10.40)	(11.06)	(12.04)	(12.67)	(11.18)	(10.65)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	98,650	98,650	97,466	97,466	96,661	96,661
R-squared	0.026	0.031	0.026	0.032	0.028	0.032

Table 1.17: Charge-off ratio and 3-year consumer loan growth

variable	Charge-off$(C)_{t+1}(1)$	Charge-off$(C)_{t+1}(2)$	Charge-off$(C)_{t+2}(1)$	Charge-off$(C)_{t+2}(2)$	Charge-off$(C)_{t+3}(1)$	Charge-off$(C)_{t+3}(2)$
Loan growh	-0.0019***	-0.0005***	-0.0009***	0.0005***	-0.0004***	0.0008***
quartile 2	(-17.41)	(-5.54)	(-8.01)	(5.40)	(-3.58)	(8.41)
Loan growh	-0.0023***	-0.0008***	-0.0008***	0.0008***	-0.0002	0.0013***
quartile 3	(-21.59)	(-8.06)	(-7.56)	(8.42)	(-1.53)	(13.04)
Loan growh	-0.0021***	-0.0009***	-0.0001	0.0013***	0.0009***	0.0020***
quartile 4	(-19.72)	(-9.01)	(-0.60)	(12.68)	(8.61)	(19.78)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	91,024	91,024	90,003	90,003	89,319	89,319
R-squared	0.021	0.025	0.017	0.027	0.021	0.031

Tests for Small versus Large Banks

The tables report estimates from the panel regression with fixed effects for nonperforming loans to loans secured by real estate. In Table 1.18, the small banks are sorted into quartiles based on the loan growth during the previous three years. Table 1.19 shows the results of the large banks. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.18: Small banks' NPL ratio and 3-year loan growth secured by real estate

variable	$NPL(RE)_{t+1}(1)$	$NPL(RE)_{t+1}(2)$	$NPL(RE)_{t+2}(1)$	$NPL(RE)_{t+2}(2)$	$NPL(RE)_{t+3}(1)$	$NPL(RE)_{t+3}(2)$
Loan growh	-0.0097**	0.0083**	-0.0033	0.0152***	-0.0001	0.0184***
quartile 2	(-3.10)	(2.80)	(-1.05)	(5.10)	(-0.02)	(6.15)
Loan growh	-0.0258***	0.0039	-0.0178***	0.0149***	-0.0112***	0.0230***
quartile 3	(-8.27)	(1.26)	(-5.70)	(4.85)	(-3.58)	(7.41)
Loan growh	-0.0541***	0.0029	-0.0423***	0.0159***	-0.0351***	0.0248***
quartile 4	(-17.47)	(0.90)	(-13.64)	(4.81)	(-11.27)	(7.44)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	96,015	96,015	95,832	95,832	95,353	95,353
R-squared	0.019	0.015	0.020	0.016	0.021	0.017

Table 1.19: Large banks' NPL ratio and 3-year loan growth secured by real estate

variable	$NPL(RE)_{t+1}(1)$	$NPL(RE)_{t+1}(2)$	$NPL(RE)_{t+2}(1)$	$NPL(RE)_{t+2}(2)$	$NPL(RE)_{t+3}(1)$	$NPL(RE)_{t+3}(2)$
Loan growh	-0.0273**	-0.0133	-0.0090	0.0011	-0.0051	0.0036
quartile 2	(-2.91)	(-1.45)	(-0.95)	(0.12)	(-0.54)	(0.39)
Loan growh	-0.0052	0.0035	0.0137	0.0203*	0.0115	0.0165
quartile 3	(-0.56)	(0.37)	(1.45)	(2.15)	(1.20)	(1.72)
Loan growh	0.0102	0.0192*	0.0211*	0.0286**	0.0176	0.0209*
quartile 4	(1.09)	(1.98)	(2.22)	(2.91)	(1.84)	(2.10)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	7,268	7,268	7,225	7,225	7,179	7,179
R-squared	0.075	0.111	0.069	0.107	0.061	0.097

The following tables report estimates from the panel regression with fixed effects for charge-offs to loans secured by real estate. In Table 1.20, the small banks sorted into quartiles based on the real estate loan growth during the previous three years. Table 1.21 shows the results of the large banks. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.20: Small banks' Charge-off ratio and 3-year loan growth secured by real estate

variable	Charge-off(RE)$_{t+1}$(1)	Charge-off(RE)$_{t+1}$(2)	Charge-off(RE)$_{t+2}$(1)	Charge-off(RE)$_{t+2}$(2)	Charge-off(RE)$_{t+3}$(1)	Charge-off(RE)$_{t+3}$(2)
Loan growh	-0.0809***	-0.0455***	-0.0309***	0.0022	-0.0025	0.0245***
quartile 2	(-22.23)	(-12.74)	(-8.44)	(0.62)	(-0.69)	(6.78)
Loan growh	-0.1014***	-0.0883***	-0.0225***	-0.0044	0.0296***	0.0442***
quartile 3	(-27.91)	(-23.97)	(-6.17)	(-1.19)	(8.14)	(11.80)
Loan growh	-0.0848***	-0.1307***	0.0180***	-0.0092*	0.0820***	0.0583***
quartile 4	(-23.44)	(-33.38)	(4.97)	(-2.30)	(22.63)	(14.46)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	96,015	96,015	95,832	95,832	95,353	95,353
R-squared	0.183	0.223	0.172	0.211	0.170	0.210

Table 1.21: Large banks' Charge-off ratio and 3-year loan growth secured by real estate

variable	Charge-off(RE)$_{t+1}$(1)	Charge-off(RE)$_{t+1}$(2)	Charge-off(RE)$_{t+2}$(1)	Charge-off(RE)$_{t+2}$(2)	Charge-off(RE)$_{t+3}$(1)	Charge-off(RE)$_{t+3}$(2)
Loan growh	-0.1767***	-0.0691***	-0.0759***	0.0296	-0.0103	0.0791***
quartile 2	(-9.18)	(-3.60)	(-3.85)	(1.50)	(-0.51)	(3.99)
Loan growh	-0.1926***	-0.0937***	-0.0642**	0.0390	0.0197	0.1156***
quartile 3	(-9.99)	(-4.74)	(-3.24)	(1.93)	(0.98)	(5.67)
Loan growh	-0.1729***	-0.1265***	-0.0282	0.0287	0.0643**	0.1118***
quartile 4	(-8.99)	(-6.23)	(-1.42)	(1.37)	(3.19)	(5.31)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	7,268	7,268	7,225	7,225	7,179	7,179
R-squared	0.321	0.364	0.289	0.333	0.268	0.322

The tables report estimates from the panel regression with fixed effects for nonperforming loans to commercial and industrial (C&I) loans. In Table 1.22, the small banks sorted into quartiles based on the C&I loan growth during the previous three years. Table 1.23 shows the results of the large banks. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.22: Small banks' NPL ratio and 3-year C&I loan growth

variable	$NPL(CI)_{t+1}(1)$	$NPL(CI)_{t+1}(2)$	$NPL(CI)_{t+2}(1)$	$NPL(CI)_{t+2}(2)$	$NPL(CI)_{t+3}(1)$	$NPL(CI)_{t+3}(2)$
Loan growh	0.0486	0.2535	0.1100	0.1286	-0.1291*	0.0537
quartile 2	(0.79)	(1.80)	(1.80)	(0.93)	(-2.11)	(0.41)
Loan growh	0.0532	0.2959*	0.1671**	0.1687	0.0452	0.1364
quartile 3	(0.87)	(2.04)	(2.74)	(1.20)	(0.75)	(1.00)
Loan growh	0.0457	0.2058	0.2245***	0.3708*	0.2551***	0.2641
quartile 4	(0.74)	(1.35)	(3.67)	(2.47)	(4.16)	(1.72)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	14,241	14,241	14,191	14,191	14,131	14,131
R-squared	0.012	0.108	0.016	0.088	0.017	0.071

Table 1.23: Large banks' NPL ratio and 3-year C&I loan growth

variable	$NPL(CI)_{t+1}(1)$	$NPL(CI)_{t+1}(2)$	$NPL(CI)_{t+2}(1)$	$NPL(CI)_{t+2}(2)$	$NPL(CI)_{t+3}(1)$	$NPL(CI)_{t+3}(2)$
Loan growh	0.0548	0.0675	0.1195**	0.1192**	0.0325	0.0072
quartile 2	(1.23)	(1.56)	(2.68)	(2.75)	(0.71)	(0.17)
Loan growh	-0.0405	0.0250	0.0173	0.0864	0.0500	0.1633***
quartile 3	(-0.91)	(0.55)	(0.38)	(1.87)	(1.09)	(3.40)
Loan growh	-0.0075	0.0519	0.0503	0.1318*	0.0796	0.1986***
quartile 4	(-0.16)	(0.95)	(1.07)	(2.39)	(1.66)	(3.45)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	1,203	1,203	1,157	1,157	1,106	1,106
R-squared	0.036	0.081	0.041	0.091	0.044	0.124

The following tables report estimates from the panel regression with fixed effects for charge-offs to C&I loans. In Table 1.24, the small banks sorted into quartiles based on the C&I loan growth during the previous three years. Table 1.25 shows the results of the large banks. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.24: Small banks' Charge-off ratio and 3-year C&I loan growth

variable	Charge-off$(CI)_{t+1}(1)$	Charge-off$(CI)_{t+1}(2)$	Charge-off$(CI)_{t+2}(1)$	Charge-off$(CI)_{t+2}(2)$	Charge-off$(CI)_{t+3}(1)$	Charge-off$(CI)_{t+3}(2)$
Loan growh	-0.4033***	-0.1403**	-0.2155***	0.0691	-0.1265**	0.1267**
quartile 2	(-9.02)	(-3.10)	(-4.70)	(1.50)	(-2.72)	(2.70)
Loan growh	-0.6520***	-0.2546***	-0.3389***	0.0402	-0.1706***	0.1286**
quartile 3	(-14.78)	(-5.52)	(-7.50)	(0.86)	(-3.73)	(2.72)
Loan growh	-0.6852***	-0.4246***	-0.2539***	0.0346	0.0059	0.2304***
quartile 4	(-15.43)	(-8.73)	(-5.56)	(0.70)	(0.13)	(4.64)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	10,494	10,494	10,335	10,335	10,201	10,201
R-squared	0.121	0.075	0.101	0.066	0.098	0.068

Table 1.25: Large banks' Charge-off ratio and 3-year C&I loan growth

variable	Charge-off$(CI)_{t+1}(1)$	Charge-off$(CI)_{t+1}(2)$	Charge-off$(CI)_{t+2}(1)$	Charge-off$(CI)_{t+2}(2)$	Charge-off$(CI)_{t+3}(1)$	Charge-off$(CI)_{t+3}(2)$
Loan growh	-0.3917***	-0.1441**	-0.2885***	-0.0438	-0.1733***	0.0723
quartile 2	(-8.78)	(-3.23)	(-6.23)	(-0.95)	(-3.64)	(1.55)
Loan growh	-0.6292***	-0.3672***	-0.3752***	-0.0770	-0.2528***	0.0494
quartile 3	(-14.10)	(-8.07)	(-8.11)	(-1.065)	(-5.30)	(1.04)
Loan growh	-0.5440***	-0.4216***	-0.2855***	-0.1169*	-0.0497	0.1421**
quartile 4	(-12.10)	(-8.90)	(-6.07)	(-2.39)	(-1.02)	(2.85)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	5,269	5,269	5,029	5,029	4,828	4,828
R-squared	0.162	0.171	0.133	0.142	0.129	0.142

The tables report estimates from the panel regression with fixed effects for nonperforming loans to the consumer loans. In Table 1.26, the small banks sorted into quartiles based on the consumer loan growth during the previous three years. Table 1.27 shows the results of the large banks. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.26: Small banks' NPL ratio and 3-year consumer loan growth

variable	$NPL(C)_{t+1}(1)$	$NPL(C)_{t+1}(2)$	$NPL(C)_{t+2}(1)$	$NPL(C)_{t+2}(2)$	$NPL(C)_{t+3}(1)$	$NPL(C)_{t+3}(2)$
Loan growh	0.0598***	0.0195***	0.0638***	0.0229***	0.0604***	0.0179***
quartile 2	(15.63)	(5.83)	(16.61)	(6.83)	(15.66)	(5.31)
Loan growh	0.0834***	0.0300***	0.0857***	0.0336***	0.0829***	0.0324***
quartile 3	(21.84)	(8.73)	(22.39)	(9.75)	(21.54)	(9.36)
Loan growh	0.0393***	0.0396***	0.0444***	0.0443***	0.0399***	0.0364***
quartile 4	(10.34)	(11.51)	(11.65)	(12.80)	(10.41)	(10.43)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	94,372	94,372	94,087	94,087	93,542	93,542
R-squared	0.026	0.033	0.029	0.034	0.030	0.033

Table 1.27: Large banks' NPL ratio and 3-year consumer loan growth

variable	$NPL(C)_{t+1}(1)$	$NPL(C)_{t+1}(2)$	$NPL(C)_{t+2}(1)$	$NPL(C)_{t+2}(2)$	$NPL(C)_{t+3}(1)$	$NPL(C)_{t+3}(2)$
Loan growh	-0.0154	-0.0249	0.0070	-0.0033	0.0175	0.0147
quartile 2	(-0.80)	(-1.61)	(0.36)	(-0.21)	(0.89)	(0.92)
Loan growh	-0.0339	-0.0326*	-0.0112	-0.0149	0.0262	0.0197
quartile 3	(-1.75)	(-2.02)	(-0.57)	(-0.89)	(1.33)	(1.17)
Loan growh	0.0342	-0.0321	0.0410*	-0.0308	0.0720***	-0.0101
quartile 4	(1.77)	(-1.93)	(2.11)	(-1.78)	(3.68)	(-0.58)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	5,017	5,017	4,938	4,938	4,861	4,861
R-squared	0.060	0.035	0.049	0.039	0.048	0.041

The following tables report estimates from the panel regression with fixed effects for charge-offs to the consumer loans. The small banks are sorted into quartiles based on the growth of consumer loans during the previous three years in Table 1.28. On the other hand, the large banks are sorted into quartiles based on the loan growth during the previous three years in Table 1.29. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.28: Small banks' Charge-off ratio and 3-year consumer loan growth

variable	Charge-off(C)$_{t+1}$(1)	Charge-off(C)$_{t+1}$(2)	Charge-off(C)$_{t+2}$(1)	Charge-off(C)$_{t+2}$(2)	Charge-off(C)$_{t+3}$(1)	Charge-off(C)$_{t+3}$(2)
Loan growh	-0.0016***	-0.0004***	-0.0007***	0.0006***	-0.0002*	0.0008***
quartile 2	(-15.65)	(-4.48)	(-6.35)	(5.87)	(-2.08)	(8.88)
Loan growh	-0.0021***	-0.0007***	-0.0006***	0.0009***	-0.0000	0.0013***
quartile 3	(-19.72)	(-6.67)	(-5.63)	(9.29)	(0.00)	(13.61)
Loan growh	-0.0022***	-0.0007***	-0.0002*	0.0013***	0.0007***	0.0020***
quartile 4	(-21.13)	(-7.49)	(-1.98)	(13.64)	(6.92)	(20.31)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	87,715	87,715	87,530	87,530	87,072	87,072
R-squared	0.023	0.024	0.022	0.028	0.026	0.032

Table 1.29: Large banks' Charge-off ratio and 3-year consumer loan growth

variable	Charge-off(C)$_{t+1}$(1)	Charge-off(C)$_{t+1}$(2)	Charge-off(C)$_{t+2}$(1)	Charge-off(C)$_{t+2}$(2)	Charge-off(C)$_{t+3}$(1)	Charge-off(C)$_{t+3}$(2)
Loan growh	-0.0051***	-0.0021**	-0.0038***	-0.0002	-0.0029**	0.0002
quartile 2	(-5.79)	(-2.96)	(-4.27)	(-0.34)	(-3.27)	(0.23)
Loan growh	-0.0064***	-0.0029***	-0.0050***	-0.0007	-0.0037***	0.0003
quartile 3	(-7.24)	(-3.98)	(-5.65)	(-0.98)	(-4.14)	(0.38)
Loan growh	-0.0033***	-0.0020**	-0.0018*	0.0006	-0.0002	0.0020**
quartile 4	(-3.71)	(-2.67)	(-2.01)	(0.79)	(-0.26)	(2.58)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	No	Yes	No	Yes
# of obs.	4,028	4,028	3,996	3,996	3,958	3,958
R-squared	0.068	0.141	0.055	0.122	0.053	0.114

1.6.5 Tables of Robustness Checks

Tables of Interact with Business Cycles

The tables show estimates from the repeated regressions with bank-fixed effects for the small banks. The results (1) are covering the all periods over 1976-2013, but the results (2) are estimated by the data in which recession periods by NBER are excluded. Numbers in parentheses are t-statistics. *, **, and *** denote statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.30: Three year loan growth and ROA

variable	$ROA_{t+1}(1)$	$ROA_{t+1}(2)$	$ROA_{t+2}(1)$	$ROA_{t+2}(2)$	$ROA_{t+3}(1)$	$ROA_{t+3}(2)$
Loan growh	0.0548***	0.0562***	-0.0092**	-0.0102**	-0.0353***	-0.0341***
quartile 2	(19.38)	(17.22)	(-3.20)	(-3.04)	(-12.19)	(-10.15)
Loan growh	0.0941***	0.0937***	-0.0078**	-0.0074*	-0.0579***	-0.0546***
quartile 3	(32.78)	(28.25)	(-2.67)	(-2.17)	(-19.69)	(-15.95)
Loan growh	0.1208***	0.1161***	-0.0060*	-0.0037	-0.0797***	-0.0735***
quartile 4	(40.41)	(33.53)	(-1.96)	(-1.05)	(-26.03)	(-20.58)
# of obs.	341,584	256,079	341,276	255,744	341,127	255,543
R-squared	0.093	0.088	0.078	0.084	0.071	0.081

Table 1.31: Three year loan growth and loan loss provisions

variable	$LLP_{t+1}(1)$	$LLP_{t+1}(2)$	$LLP_{t+2}(1)$	$LLP_{t+2}(2)$	$LLP_{t+3}(1)$	$LLP_{t+3}(2)$
Loan growh	0.0365***	0.0353***	0.0658***	0.0658***	0.0689***	0.0702***
quartile 2	(21.23)	(18.03)	(38.30)	(33.51)	(40.04)	(35.70)
Loan growh	0.0453***	0.0420***	0.1040***	0.1018***	0.1170***	0.1159***
quartile 3	(25.97)	(21.08)	(59.69)	(51.00)	(66.95)	(57.91)
Loan growh	0.0598***	0.0525***	0.1351***	0.1281***	0.1563***	0.1522***
quartile 4	(32.92)	(25.25)	(74.42)	(61.47)	(85.90)	(72.88)
# of obs.	341,575	256,071	341,269	255,737	341,121	255,538
R-squared	0.128	0.138	0.134	0.154	0.134	0.130

Table 1.32: Three year loan growth and equity capital ratio

variable	$ECR_{t+1}(1)$	$ECR_{t+1}(2)$	$ECR_{t+2}(1)$	$ECR_{t+2}(2)$	$ECR_{t+3}(1)$	$ECR_{t+3}(2)$
Loan growh	-0.1154***	-0.1262***	-0.1432***	-0.1598***	-0.1241***	-0.1318***
quartile 2	(-12.11)	(-11.14)	(-14.22)	(-13.29)	(-11.99)	(-10.66)
Loan growh	-0.3034***	-0.3283***	-0.3379***	-0.3729***	-0.3198***	-0.3565***
quartile 3	(-31.36)	(-28.51)	(-33.07)	(-30.50)	(-30.47)	(-28.37)
Loan growh	-0.6187***	-0.6690***	-0.6747***	-0.7404***	-0.6257***	-0.6923***
quartile 4	(-61.40)	(-55.64)	(-63.40)	(-58.01)	(-57.23)	(-52.77)
# of obs.	341,584	256,079	341,276	255,744	341,127	255,543
R-squared	0.080	0.079	0.068	0.068	0.061	0.062

Table: Cumulative Effect of Loan Growth

The table reports estimates from the panel regression with bank-fixed effects for various performance indicators of the small banks in subsequent three years. The results expressed by "C_" are estimated by the cumulative variables defined by aggregating earnings over the future three years divided by average total assets or average equity capital over the future three years. Numbers in parentheses are t-statistics. *, **, and *** denote statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.33: Three year loan growth and cumulative performance

variable	ROA_{t+3}	C_ROA	LLP_{t+3}	C_LLP	ECR_{t+3}	C_ECR
Loan growh	-0.0353***	-0.0076*	0.0689***	0.1419***	-0.1241***	-0.1751***
quartile 2	(-12.19)	(-1.98)	(40.04)	(11.27)	(-11.99)	(-14.06)
Loan growh	-0.0579***	-0.0076	0.1170***	0.2011***	-0.3198***	-0.3713***
quartile 3	(-19.69)	(-1.95)	(66.95)	(15.69)	(-30.47)	(-29.28)
Loan growh	-0.0797***	-0.0220***	0.1563***	0.2259***	-0.6257***	-0.6211***
quartile 4	(-26.03)	(-5.32)	(85.90)	(16.58)	(-57.23)	(-46.14)
# of obs.	341,127	283,663	341,121	283,655	341,127	284,681
R-squared	0.071	0.072	0.134	0.026	0.061	0.064

Tables: Earning Performance and Disaggregated Loan Growth

The tables report estimates from the repeated regressions with bank-fixed effects for earning performance of the small banks. The results expressed by "ROA(T)" are estimated by total loan growth quartiles. In the other hand, the results expressed by "ROA(RE)" are estimated by real estate loan growth quartiles. Numbers in parentheses are t-statistics. *, **, and *** denote statistical significance at 5%, 1%, and 0.1% levels, respectively.

Table 1.34: Three year real estate loan growth and ROA

variable	ROA_{t+1}(T)	ROA_{t+1}(RE)	ROA_{t+2}(T)	ROA_{t+2}(RE)	ROA_{t+3}(T)	ROA_{t+3}(RE)
Loan growh	0.0548***	0.0311***	-0.0092**	-0.0057*	-0.0353***	-0.0165***
quartile 2	(19.38)	(10.91)	(-3.20)	(-1.97)	(-12.19)	(-5.64)
Loan growh	0.0941***	0.0549***	-0.0078**	-0.0083**	-0.0579***	-0.0312***
quartile 3	(32.78)	(19.07)	(-2.67)	(-2.81)	(-19.69)	(-10.57)
Loan growh	0.1208***	0.0704***	-0.0060*	-0.0076*	-0.0797***	-0.0450***
quartile 4	(40.41)	(23.57)	(-1.96)	(-2.51)	(-26.03)	(-14.70)
# of obs.	341,584	339,078	341,276	338,611	341,127	338,338
R-squared	0.093	0.091	0.078	0.079	0.071	0.070

Table 1.35: Three year C&I growth and ROA

variable	ROA_{t+1}(T)	ROA_{t+1}(CI)	ROA_{t+2}(T)	ROA_{t+2}(CI)	ROA_{t+3}(T)	ROA_{t+3}(CI)
Loan growh	0.0548***	-0.0079*	-0.0092**	-0.0325***	-0.0353***	-0.0454***
quartile 2	(19.38)	(-2.43)	(-3.20)	(-9.94)	(-12.19)	(-13.95)
Loan growh	0.0941***	0.0197***	-0.0078**	-0.0366***	-0.0579***	-0.0650***
quartile 3	(32.78)	(6.03)	(-2.67)	(-11.07)	(-19.69)	(-19.79)
Loan growh	0.1208***	0.0322***	-0.0060*	-0.0395***	-0.0797***	-0.0829***
quartile 4	(40.41)	(9.84)	(-1.96)	(-11.93)	(-26.03)	(-25.21)
# of obs.	341,584	245,092	341,276	244,887	341,127	244,771
R-squared	0.093	0.062	0.078	0.047	0.071	0.040

Table 1.36: Three year consumer loan growth and ROA

variable	ROA_{t+1}(T)	ROA_{t+1}(C)	ROA_{t+2}(T)	ROA_{t+2}(C)	ROA_{t+3}(T)	ROA_{t+3}(C)
Loan growh	0.0548***	0.0519***	-0.0092**	0.0156***	-0.0353***	-0.0040
quartile 2	(19.38)	(18.32)	(-3.20)	(5.39)	(-12.19)	(-1.39)
Loan growh	0.0941***	0.0816***	-0.0078**	0.0319***	-0.0579***	0.0013
quartile 3	(32.78)	(28.45)	(-2.67)	(10.88)	(-19.69)	(0.43)
Loan growh	0.1208***	0.0790***	-0.0060*	0.0247***	-0.0797***	-0.0124***
quartile 4	(40.41)	(27.38)	(-1.96)	(8.36)	(-26.03)	(-4.20)
# of obs.	341,584	337,533	341,276	337,067	341,127	336,794
R-squared	0.093	0.092	0.078	0.079	0.071	0.069

Chapter 2

Bank Market Discipline in the Developing Market

Economists and bank regulators have been interested in involving the market more in bank supervision, particularly through the use of subordinated debt issued by banks[1]. Bank supervisors anticipate that market investors in subordinated debts could discipline banks that issued the debts by controlling banks' excessive risk-taking and provide information about default risk that prevents the supervisors from forbearing against problem banks. Based on the anticipation, subordinated debt has been regarded as regulatory capital since the risk-based capital framework was proposed by the Basel Committee on Banking Supervision.

How might the market discipline banks through the use of subordinated debts? Such debts could provide direct discipline if yields are positively related to bank risk measures. Predicting higher funding costs from increased bank risk, banks may have the incentive to prudently manage excessive risk-taking. Furthermore, subordinated debts provide indirect discipline if the information contained in secondary market prices helps in the supervisory process [Goyal (2005)].

Previous studies about the market discipline have focused on the relation between subordinated debt yield and bank risk measures in the developed financial market such as United States and Canada[Avery et al. (1988), Gorton and Santomero (1990), Flannery and Sorescu (1996), Beyhaghi et al. (2014)]. Early papers by Avery et al. (1988) and Gorton and Santomero (1990) investigate accounting reports and do not find any evidence of a relation between yields on bank subordinated debt and bank risk measures. In contrast, Flannery and Sorescu (1996) and Jagtiani et al. (2002) show that during the late 1980s and early 1990s, as bank regulators were willing to allow subordinated debtholders to absorb losses, yields on the debt correlated more closely with accounting risk measures.

[1]Flannery (2001) expresses "market discipline" in terms of two distinct meanings. The one is the market influence by stakeholders, and the other is the market monitoring by the security prices. The former means that stakeholders directly induce a bank not to hold excessively risky assets. On the other hand, the latter implies that a bank's behavior is indirectly affected by by price changes.

However, there is not any research on the efficacy of market discipline in the developing financial market like South Korean the early 2000s. Also, existing analyses were conducted for the subordinated debts issued by large banks such as bank holding companies in the U.S. Hence, there is no evidence that market discipline could be effective on the small banks with different risk profiles in comparison to large banks.

The banking sector in South Korea is appropriate to analyze those questions empirically. First, the debt market in South Korea was not as developed U.S in early 2000s. For instance, most subordinated debts were not traded in a secondary market after they were issued. So, they could not be provide secondary market price information. Second, there is a unique banking industry, named by mutual saving banks, that can be compared with large banks for analyzing the effects of size on market discipline. Mutual saving banks are allowed to do their business within an authorized area, and their size is relatively small in comparison to commercial banks in South Korea. Nevertheless, they have to meet basic regulatory capital requirements and are able to issue subordinated debts to raise their capital adequacy ratio. Therefore, the efficacy of market discipline can be compared between the mutual saving banks and the commercial banks.

In this paper, I empirically address the following questions: (1) does market discipline work properly even in developing financial markets?, and (2) is the market discipline for smaller and more risky banks less effective? In order to implement market discipline well, market investors who can pinpoint a financial vulnerability of a bank will be able to control a bank's risk-taking by including restrictive covenants or adjusting secondary market prices. If the market investors fail to do so, the discipline may not work properly. Moreover, if the secondary market for the subordinated debts is not well equipped, the discipline through pricing may be limited. Levonian (2001) also argues that a substitution away from equity to subordinated debt in a bank's capital structure only increases leverage, leading to excessive risk-taking. Hence, if a bank issues subordinated debt rather than equity, its risk-taking incentives may increase.

These research questions are examined using a sample of 169 subordinated debts issued by commercial banks and a sample of 73 subordinated debts issued by mutual saving banks

during the 2004-2017 period. Following Flannery and Sorescu (1996), I use both linear and nonlinear panel regression models that accounts for the relation between yield spreads and accounting risk measures of banks. In order to compare the efficacy of market discipline between commercial banks and mutual saving banks, I run regressions for each of the two bank groups.

The results show that the market discipline in subordinated debt yields does not work well in South Korea. Investors of subordinated debts issued by the commercial banks are likely to be affected by bank size or external economic conditions, not by bank risk measures. These imply that subordinated debtholders focus more on external conditions and have little incentive to control excessive risk-taking of banks. Such results may be due to investors' moral hazard based on "too-big-to-fail".

The results from the mutual saving banks are different from those of the commercial banks. As for the mutual saving banks, bank size does not matter for investors. Although some accounting factors and external conditions are significantly related to yield spreads, not all results are consistent with a single theory of market discipline. In particular, the effects of external conditions on spreads are largest, and the external conditions drove down the yield spreads even in trough periods. As a result, the variations of the spreads cannot be consistently explained in terms of a variety of risk measures among mutual saving banks. Hence, investors may not be able to evaluate bank risk information rigorously.

The findings have implications of banking regulations. The market discipline mechanism in regulatory capital framework may not work well in emerging countries that do not yet have a sophisticated financial system. In particular, it should be prudently applied for small-sized banks with relatively risky assets in countries where subordinated debt is recognized as Tier 2 capital.

The paper is structured as follows. Section 2.1 describes the data used in my analysis. Section 2.2 introduces the regression methodology. It also presents the main results - using accounting risk measures, bank size, and time dummies to dissect their effects on yield spreads of subordinated debts of commercial banks and mutual saving banks. Finally, Section 2.3 concludes. I also provide the last section, which reports additional details regarding data

construction and results of the estimations.

2.1 Data

2.1.1 Sample Construction

Two types of data are required to evaluate the relation between bank risks and subordinated debt pricing: subordinated debt yield premia and the issuing banks' contemporaneous financial characteristics.

Subordinated Debt Yield Premia

The Bond Information Service of Korea Financial Investment Association reports all information on private and government debt issues traded in the South Korea. I identify all fixed-rate, nonconvertible subordinated debts on the Bond Information Service issued by commercial banks and mutual saving banks, and collect data on their maturity and coupon rate at the time issued during the period 2004 through 2017.

The subordinated debt issues that I collect have identical institutional features. The subordinated debts are junior to uninsured deposits. In aggregate, the ratio of the debts to total liabilities is less than 2% for the commercial banks and less than 1.5% for the mutual saving banks [2]. In South Korea, bank subordinated debts were sold at branches of issuing banks and most debentures were not traded in the secondary bond market. Therefore, I use the issuing prices, not live trader quotes. My subordinated debt sample includes a total of 169 issues for 13 different banks and 73 issues for 28 different mutual saving banks.

[2]In the case of the mutual saving banks, the ratio of the subordinated debts to total liabilities at the end of 2010 is 1.38%, the highest level between 2004 and 2013. Since the early 2000's, mutual saving banks sharply increased loans for real estate constructions. After the global financial crisis, the mutual saving banks experienced deteriorating credit soundness such as a rapid increase in their nonperforming loans related to real estate. The financial authority required mutual saving banks to raise their regulatory capital and then the relatively sound banks issued subordinated debts. Therefore, the ratio of subordinated debts is the highest at the end of 2010. Nevertheless, 32 of 105 mutual saving banks have gone bankrupt since 2011. Even though 19 bankrupt banks were merged by other banks through P&A (purchase and assumption), holders of subordinated debts issued by 12 mutual saving banks lost most of their money.

To calculate a default risk premium or credit spread for each subordinated debt, I also collect the yield to maturity on a Korean government bond with approximately the identical maturity date as the bank debt and the same issuing period. The credit spread is calculated as the difference between the bank debt yield and the corresponding government bond yield. Since subordinated debt issues and government bonds are not callable, not adjustment for a call option is required.

Bank Accounting Risk Data

I hypothesize that a bank's spread should be increasing in the amount of the bank's risk implied by its accounting reports, as measured by loan soundness, leverage, and profitability. The data should correspond to quarter or semi-annual dates for which I have collected the debts prices. Such information is readily available from the Financial Statistics Information System in the Financial Supervisory Service that is a financial watchdog in South Korea. The system does not include detailed information about loan soundness before 2000. The data frequently is quarterly for commercial banks but only semi-annual for mutual saving banks.

2.1.2 Sample Statistics

I show what characteristics the sample has for various variables (e.g., Spreads, profitability indicator as ROA, indicators of loan soundness as loan loss provisions and nonperforming loan, and leverage). Table 2.1 and 2.2 show sample summary statistics. Overall, the mutual saving banks tend to be regarded as the banking institutions with high risk because they hold riskier loans than the commercial banks given the credit soundness indicators in the accounting reports.

First, the tables of summary statistics report that the spreads between subordinated debt yield and the government bond yield indicate that mutual saving banks' spreads are much higher than those of commercial banks. While the median spread of the commercial banks is 0.85%, the median spread of the mutual saving banks is 3.75%. The huge difference of yield spread between the commercial banks and the mutual saving banks is caused by the

differences of accounting default risk measures such as loan loss provisions and nonperforming loans that are described in the following paragraph.

Second, the tables show that, while mutual saving banks' size is smaller than that of commercial banks, the loan soundness of the mutual saving banks is worse than that of the commercial banks. Both indicators of loan loss provisions (LLP) and nonperforming loans (NPL) disclose the soundness of loans. They are expressed in percentage terms. The former is calculated as loan loss provisions divided by total gross loans multiplied by 100. While the median commercial bank sets aside 1.45% of gross loans as loan loss provisions, the median mutual bank holds 4.18% as a reserve. Basically, the proposition of high LLP implies that the loans will be more probable not to be repaid at the due date and banks hold reserves for the expected default loans. So, the higher ratio could reflect greater expected default risk. Alternatively, the high ratio might make a good market reaction because loan loss provisions are proactive actions against the future risk of potential default loans and are completely preempted as a source of bad news [Liu and Ryan (1995)].

The nonperforming loans (NPL) mean the ratio of nonaccrual loans to total gross loans. Larger ratio should raise the spread, either because it implies that the bank is in poor condition, or because high nonaccruals indicate greater uncertainty about the bank's future performance. The median commercial bank has 1.33% of gross loans as nonperforming loans. On the other hand, that of the mutual saving banks is 6.69%, which implies the loan quality of the mutual saving banks is much worse than that of the commercial banks.

Third, I use ROA as the accounting profitability indicator. The year t ROA is defined as net income divided by total assets multiplied by 100 and is expressed as a percentage. Higher ROA could reflect greater profitability or efficiency, which would imply that ROA should be negatively related to the spread. Alternatively, higher ROA might reflect primarily compensation for higher risk-taking, which should make it positively related to the spread. According the Korean data, while the median commercial bank has an ROA of 0.17%, the case of the mutual saving bank has an ROA of 0.80%. There is a huge difference between the commercial banks and the mutual saving banks in terms of total assets, but profit is not much different between the two bank groups.

Fourth, all else equal, higher leverage (LEV) increases the risk of bank failure. Leverage is defined as total assets divided by Tier 1 capital following the Basel III standard. Previous research [e.g. Collin-Dufresn et al. (2001), Geanakoplos (2010)] finds that higher leverage raises default risk. The median commercial bank has a leverage of 58.80 and the mutual saving bank in the median has a leverage of 46.88, which may indicate that the commercial banks may have easier access to a variety of borrowers.

Lastly, I consider other control variables such as the log of banks' total assets (LTA) and time dummies. The former indicator (LTA) could capture either of two effects. First, larger banks might be considered less risky, because they are better diversified, better managed, or more likely to benefit from the "too-big-to-fail" concept. Second, larger banks' subordinated debt issues are likely to be more liquid, and hence to trade at lower spreads over government bonds. The latter indicators, time dummies, consist of quarterly dummies for the commercial banks or semi-annual dummies for the mutual saving banks. They are able to capture intertemporal variations in financial market conditions as well as macroeconomic conditions.

2.2 Empirical Results

2.2.1 Regression Methodology

Flannery and Sorescu (1996) define "market discipline" as the process by which informed market investors collect and evaluate information about a firm's activities and prospects, and incorporate that information into its traded securities. For market discipline to work well, investors must predict future changes in bank risk and price the effects into securities. In other words, such predictive pricing disciplines bank managers, in the sense that it causes them to take into account the full impact of their business decisions on all bank claimants. Therefore, it is necessary to examine if the prices of subordinated debts are sensitive to bank risks after controlling for other time-varying effects.

One important question is whether the efficacy of market discipline varies in relation to bank's size. So, I divide whole banks in South Korea into commercial banks and mutual

saving banks and then investigate whether or not the discipline works regardless of the banks' size or characteristics. For this, I run both linear and nonlinear panel regressions following the approach of Flannery and Sorescu (1996).

First, let me introduce the linear specification, which can be interpreted as an approximation to a monotonic relation between the spread of subordinated debt and bank risk as follows:

$$SPREAD_{i,t} = \beta_0 + \sum_{k=1}^{4} \beta_k X_{k,i,t-1} + \beta_5 ln(TA_{i,t-1}) + \sum_{j=6}^{J} \beta_j Y_{j,i,t} + \varepsilon_{i,t} \qquad (3)$$

where $SPREAD_{i,t}$ is the difference between the subordinated debt yield to maturity of bank i and the yield of a Korean government bond with the same maturity at date t, $X_{k,i,t-1}$ are measures of bank i's risk at date $t-1$ such as loan loss provisions, nonperforming loans, leverage, $ln(TA_{i,t-1})$ is bank i's log of total assets at date $t-1$, and $Y_{j,i,t}$ are other control variables affecting bank i's subordinated debt spread at date t as time dummies [3].

The linear specification may be theoretically inappropriate because it does not reflect the nonlinear, interactive effect of asset risk and leverage on risky bond's default premium. In order to assess how the nonlinear specification results, I estimate a nonlinear relationship between the spread and bank accounting risk measures as below:

$$SPREAD_{i,t} = \beta_1 + [\beta_2 ROA_{i,t-1} + \beta_3 NPL_{i,t-1} + \beta_4 LLP_{i,t-1}] \times [LEV_{i,t-1} + \beta_5 {LEV_{i,t-1}}^2] + \beta_6 ln(TA_{i,t-1}) + \sum_{k=7}^{K} \beta_k Y_{k,i,t} + \upsilon_{i,t} \qquad (4)$$

where $SPREAD_{i,t}$, the risk measures of the banks, $ln(TA_{i,t-1})$, and $Y_{k,i,t}$ are defined as the same as the previous equation. The first bracketed expression measures the bank's asset risk, while the second bracketed expression allows a nonlinear effect of leverage on the spread. In addition, the effect of any accounting variable on the spread depends on the value of one or

[3]The time, $t-1$, of $X_{k,i,t-1}$ is basically 3 to 5 months prior to the time of the dependent variable, $SPREAD_{i,t}$. While the bank-specific data is regularly reported, the time of debt issuing is not regularly. Therefore, the time gap is not exactly a quarter.

more other independent variables.

Finding nonzero coefficients on any of the bank risk measures through two specifications is consistent with the hypothesis that market investors were pricing bank default risk over the sample period. While the individual coefficients are of some interest, their individual significance levels can be understated if the different risk measures are correlated with one another. Consequently, the efficacy of market discipline is best evaluated through F-statistics which test for the joint effect of bank risk measures on the spread. Hence, I report the F-statistics in the following tables for the estimation results.

I estimate regressions on both groups of the commercial banks and the mutual saving banks separately. Then I will compare market discipline in the commercial banks with that of the mutual saving banks. Basically, the commercial banks have greater size and more qualified risk management, so their risk profiles may be less risky than the mutual saving banks. This can lead to a lower spread when they issue subordinated debt. Given the summary statics, the mutual banks' subordinated debts have on average higher yield spreads than those of the commercial banks by 2.84%. Therefore, I conjecture the commercial banks' spreads could be more clearly explained by the banks' risk measures than those of the mutual saving banks.

2.2.2 Linear Panel Regression of Spread on Bank Risk Factors

Table 2.3 reports the results from pooled time-series, cross-section regressions for the commercial banks and the mutual saving banks. The first column estimates my model for the commercial banks. Neither asset quality variables (NPL and LLP) nor leverage (LEV) significantly affected the spread for both bank groups. ROA has a positive, marginally significant coefficient, implying that higher ROA was primarily viewed as a compensation for higher risk-taking in the case of the commercial banks. The effect of ROA is 0.42 and a 1 standard deviation increase in the ratio will raise 0.05% of the spread yield.

Also, the significantly negative coefficient on the log of total assets as a bank's size indicates that larger banks pay lower spreads. This implies that debtholders may have the mind of "too-big-to-fail". Moreover, many of the time-dummies differ reliably from zero.

Note in particular the large positive coefficients for quarters of 2008 when the global financial crisis occurred. These indicate that market investors focus more on the external market conditions than the accounting risk measures of the commercial banks.

The regression's F-statistic testing whether the four bank risk measures (NPL, LLP, LEV, and ROA) jointly differ from zero is not significant ($p = 0.184$), but the F-statistic for the hypothesis that all five coefficients including LTA differ from zero is significant ($p = 0.0001$). These results provide evidence that market investors were not sensitive to the bank risk measures but rather bank's size and external economic conditions.

Column 2 of Table 2.3 shows that the regression results for the mutual saving banks provide no real evidence that investors were pricing the subordinated debts in relation to perceived bank risks and bank's size. All coefficients of bank specific variables are not significant. The signs of the coefficients except ROA [4] are identical to those of the commercial banks. However, the hypothesis that all four bank risk measures carry zero coefficients is significantly rejected at better than the 1 percent level ($p = 0.0015$). In other words, the four accounting risk measures as a group explain a significant proportion of the variation in the spread. That would indicate that risk is jointly priced.

The impacts of the external economic conditions on pricing the debts are different from those of the commercial banks. Even though many coefficients of time dummies are significant, the signs of coefficients in 2008 are negative, which are opposite to those of the commercial banks. That means higher market uncertainty leads to lower spreads. It is difficult to theoretically explain why this occurred. One plausible interpretation is that speculative investors tend to demand the high risk bonds in South Korea when uncertainties in the macroeconomic conditions and the financial market increase sharply. In other words, the debt of mutual saving banks may have been perceived as safer than other securities during the financial crisis.

Taken together, I do not find any strong evidence that the subordinated debt investors heed accounting measures of bank risk. Rather, bank size is crucial for market investors of

[4]ROA has a negative, marginally not significant coefficient, indicating that more profitable mutual saving banks were regarded as less likely to default.

the debts issued by the commercial banks. External conditions have significant impacts on the commercial banks as well as the mutual saving banks.

2.2.3 Nonlinear Panel Regression of Spread on Bank Risk Factors

The estimation in Table 2.4 evaluates the importance of accounting risk measures without imposing the linearity of the previous estimation of Table 2.3. Note that the numbers reported for the first four variables listed (ROA through LLP) are not the simple coefficient estimates for β_2 through β_5. Instead, I report the estimated derivative of the dependent variable, SPREAD, with respect to each balance sheet variable, and the associated t-statistics, based on a Wald test. Table 2.4 provides the standard information for LTA and the time dummies: their coefficient estimates and t-statistics.

Like the linear estimation, the first column estimates my nonlinear model for the commercial banks. The results in Table 2.4 overall resemble those in Table 2.3. In detail, I do not find any significant evidence for pricing the subordinated debts with bank risk measures, and ROA as an indicator of profitability does not have a significant coefficient, either. However, LTA still has the significantly negative coefficient indicating that the size matters as well. Many of the time-dummies also differ reliably from zero and the pattern of the significant dummies is similar to those in the linear regression. The regression's F-statistic testing whether the four bank risk measures (NPL, LLP, LEV, and ROA) jointly differ from zero is not significant ($p = 0.644$), but the F-statistic for the hypothesis that all five coefficients including LTA equal zero is significant ($p = 0.004$). Given these results, I conjecture again that market investors were not considering accounting measures of bank risk but rather they were sensitive to a bank's size and external economic conditions.

This nonlinear regression for the mutual saving banks (column 2) provides some significant and interesting results. Unlike the commercial banks, ROA and credit soundness indicators are consistent with the theoretical hypothesis. In detail, ROA in the mutual banks has a significantly negative relation to the spread of the debts, indicating high profitability leads to low spreads. An increase in ROA decreases 0.002% of the yield spread. In terms of economic

significance, a 1 standard deviation increase in ROA will also decrease 0.002% of ROA in the mutual saving banks.

As for the credit soundness, NPL reflecting a poor loan quality is positively related to the yield spread even though the magnitude of the coefficient (0.001) is relatively small. However, LLP is negatively related to the spread, which indicates that debt investors might regard high LLP as the proactive action of future risk. The effect of LLP is 0.001% and a 1 standard deviation increase in the ratio will decrease 0.003% of the yield spread. The signs of coefficients of all explanatory variables are compatible with those of the linear estimation except a few coefficients of time dummies. Moreover, the coefficients of ROA and accounting risk measures are significant at the 90% or better confidence level. In addition, the hypothesis that all four bank risk measures carry zero coefficients is soundly rejected at better than the 5 percent level ($p = 0.036$).

Nonetheless, there are a couple of puzzles related to the yield spreads of the debt issued by the mutual saving banks. The coefficient of leverage as well as many coefficients of time dummies significantly differ from zero but they have opposite signs to those of the commercial banks. Such results are not consistent with the existing rationale. Concretely, the coefficient of leverage has a significantly negative relation to the yield spread of the subordinated debt. This means that higher leverage leads to lower yield spread, indicating the debtholders are likely to demand the debts of high leveraged mutual saving banks. Also, the signs of coefficients in trough periods such as 2008 are significantly negative, which is similar to the results of the linear specification [5]. While the yield spread of the mutual bank debts on average is much higher than that of the commercial banks, the variations of the mutual bank debts cannot be consistently explained by accounting risk measures of the banks.

[5]One possible explanation is that only the soundest mutual saving banks could issue debt during the crisis. Mutual saving banks that were viewed as more likely to default issued no debt during that time because, if they did, they would pay extremely high spreads. It seems that the results might be due to sample selection bias. In order to examine roughly the possibility, I compare mean values of yield spreads in non-crisis period between the mutual saving banks that issued in crisis period and the other mutual saving banks. The mutual saving banks that issued between December 2008 and September 2009 had, on average, a yield spread of 3.75% (coupon rate: 8.37%) in non-crisis period. The mean spread is a little lower than the other mutual saving banks that had a mean yield spread of 3.87% (coupon rate: 8.37%). Moreover, a mean spread of subordinated debts that were issued in crisis period (3.74%) is approximately same as that in non-crisis period. Therefore, the mutual banks issued in crisis period may not be much safer than the other banks.

Taken together, the findings from the commercial banks provide little evidence for market discipline because investors do not pay attention to accounting measures of bank risk. Like the results of the linear estimation, a bank size and external conditions are important factors in creating price differences in the subordinated debts. By contrast, the nonlinear estimation from the mutual saving banks provides some significant results. The investors in the subordinated debts of the mutual saving banks are likely to have a speculative motive even in the very uncertain periods. Unless debt investors have their own practices of rigorously analyzing bank risk measures, market discipline will not operate well.

2.3 Discussion and Conclusion

The bank regulatory policy debate related to market discipline has focused on whether subordinated debtholders can effectively monitor banks' risk taking incentives. The existing literature mostly examines correlations between yield spreads on actively traded subordinated debts and accounting risk measures of the large banks in the developed countries such as the United States. Instead of investigating subordinated debt discipline only in large banks of developed countries, I examine the efficacy of the discipline on banks in a developing debt market that includes banks with relatively risky assets.

My paper finds little evidence of market discipline in South Korea. Debtholders of commercial banks are affected by these banks' size or external conditions at specific times, not by accounting risk measures of the banks. There is some evidence of the subordinated debt discipline for mutual saving banks. I find that mutual saving banks' subordinated debt spreads are positively related to nonperforming loans and negatively related to return on assets. However, it is puzzling why more highly levered mutual savings banks seem to pay lower spreads.

These results have implications for bank regulations. Subordinated debt discipline may not work well in developing financial markets without sophisticated investors. Also, the discipline mechanism should be prudently applied for small banks with relatively risky loans.

In future research, it would be helpful to validate whether the market discipline are

working well in another developing countries. This paper dealt only with the South Korean case. Therefore, these conclusions may not hold for other developing countries without rigorous analysis of the situations in those countries.

In addition, it would be interesting to extend the analysis of the market discipline to the disclosure requirement of the Basel Committee. The Committee designated the requirement as one of the three pillars of bank regulations and has enhanced it. Therefore, it is timely to ask whether a more stringent requirement to disclose a bank's risk profile can be effective in preventing banks from engaging in excessive risk. This question is left for future research.

2.4 Tables

2.4.1 Sample Summary Statistics

I construct a panel data set with quarterly (commercial banks) or semi-annual (mutual saving banks) observations from 2003 to 2017. Variables are as follows. SPREAD is obtained by taking the difference between the yield of the subordinated debt issued by commercial banks and mutual saving banks, respectively, and the government bond with the approximately same maturity. An indicator as the profitability is returns on assets (ROA). There are also three variables for bank risk measures such as leverage (LEV), loan loss provisions (LLP), and nonperforming loans (NPL). In detail, LEV is calculated as total assets divided by Tier 1 capital following the leverage ratio of Basel III. LLP is the ratio of loan loss provisions to total gross loans, and NPL is the ratio of nonaccrual loans to total gross loans. In addition, an indicator as a bank's size is the log of a bank's total assets (LTA). All statistics are pooled across banks and time.

Table 2.1: Commercial Banks

Variable Name	obs.	Mean	St.Dev	Min.	25^{th} pec.	Median	75^{th} pec.	Max.
SPREAD (%)	169	1.00	0.56	0.06	0.59	0.85	1.18	2.70
ROA (%)	169	0.17	0.13	-0.31	0.10	0.17	0.24	1.10
Leverage	169	64.39	37.23	14.95	32.05	58.80	90.14	155.52
Loan loss provisions (%)	169	1.48	0.65	-1.44	1.23	1.45	1.78	4.10
Nonperforming loans (%)	169	1.40	0.62	0.51	0.97	1.33	1.67	4.83
ln(Total Assets)	169	17.97	1.28	14.53	16.89	18.49	19.06	19.41

Table 2.2: Mutual Saving Banks

Variable Name	obs.	Mean	St.Dev	Min.	25^{th} pec.	Median	75^{th} pec.	Max.
SPREAD (%)	73	3.84	0.69	2.80	3.50	3.75	4.00	8.17
ROA (%)	73	0.80	1.24	-2.54	0.09	0.80	1.78	3.03
Leverage	73	66.07	96.40	8.06	20.52	46.88	71.22	548.85
Loan loss provisions (%)	73	4.74	2.30	1.37	3.51	4.18	5.33	15.12
Nonperforming loans (%)	73	7.58	5.19	1.92	4.88	6.69	7.59	32.07
ln(Total Assets)	73	14.16	0.69	12.42	13.68	14.29	14.66	15.41

2.4.2 Result of Linear Specification

The Table 2.3 reports estimates from the linear panel regression with time fixed effects. Dependent variable is the spread of the subordinated debts (SPREAD). Explanatory variables are as follows: returns on assets (ROA), leverage (LEV), nonperforming loans (NPL), loan loss provisions (LLP), log of total assets (LTA), and time dummies. Estimated standard errors are computed using White's method. Heteroskedasticity-consistent t-statistics are reported in parentheses below each coefficient estimate. F^a is F-statistic for the hypothesis that four coefficients of ROA, LEV, NPL, and LLP are jointly zero. F^b is also F-statistic for the hypothesis that five coefficients including LTA are jointly zero. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

2.4.3 Result of Nonlinear Specification

The Table 2.4 reports estimates from the nonlinear panel regression with time fixed effects. Dependent variable (SPREAD) and explanatory variables (ROA, LEV, NPL, LLP, LTA, and time dummies) are identical to the previous linear model. The reported estimates and their t-statistics in parentheses are not for the simple coefficients. Rather, I report the derivative of dependent variable with respect to each explanatory variable, evaluated at the mean value of all explanatory variables. F^a is F-statistic for the hypothesis that four coefficients (ROA, LEV, NPL, and LLP) are jointly zero. F^b is also F-statistic for the hypothesis that five coefficients including LTA are jointly zero. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

Table 2.3: Linear Panel Regression of Spread on Bank Risk Factors

Variable	Commercial Banks	Mutual Saving Banks
ROA	0.4221*	-0.0524
	(1.83)	(-1.33)
LEV	0.0001	-0.0003
	(0.16)	(-1.27)
NPL	0.0293	0.0242
	(0.66)	(1.20)
LLP	-0.0560	-0.0005
	(-1.55)	(-0.01)
LTA	-0.0573***	-0.0252
	(-3.38)	(-0.43)
D04Q4	-0.0196	1.0072***
	(-0.07)	(33.01)
D05Q4	-0.0039	-1.1863***
	(-0.02)	(-10.59)
D08Q2	0.7988**	-1.5217***
	(3.11)	(-8.19)
D08Q3	1.2919***	-
	(6.45)	
D08Q4	1.1447***	-0.5191***
	(4.86)	(-2.96)
D09Q1	0.5684**	-
	(2.43)	
D11Q3	0.5611**	-
	(2.34)	
D12Q1	-0.4967**	-
	(-2.75)	
F^a	1.58	5.11***
F^b	5.61***	4.13***
# of obs.	169	73
R-squared	0.87	0.88

Table 2.4: Nonlinear Panel Regression of Spread on Bank Risk Factors

Variable	Commercial Banks	Mutual Saving Banks
ROA	-0.0000	-0.0018**
	(-0.00)	(-2.24)
LEV	71.1855	-0.0020***
	(0.00)	(-5.34)
NPL	0.0000	0.0009**
	(0.00)	(2.17)
LLP	-0.0000	-0.0012*
	(-0.00)	(-1.87)
LTA	-0.0605***	-0.0068
	(-3.24)	(-0.11)
D04Q4	0.0678	-2.6127***
	(0.23)	(-6.10)
D06Q2	-0.4966*	-4.4313***
	(-1.77)	(-13.46)
D08Q2	0.7646***	-5.1217***
	(2.85)	(-14.75)
D08Q3	1.1880***	-
	(4.74)	
D08Q4	0.9647***	-4.0734***
	(3.63)	(-12.71)
D09Q4	-0.5164	-4.3569***
	(-1.53)	(-13.99)
D11Q3	0.4746*	-
	(1.85)	
D12Q2	-0.4601*	-
	(-1.78)	
F[a]	0.63	2.78**
F[b]	3.98***	2.39**
# of obs.	169	73
R-squared	0.87	0.87

Chapter 3

Do Funding Constraints Matter for Lending Behavior?: Evidence from Small and Large Banks

The global financial crisis of 2007-2008 revealed the risks of a bank's excessive reliance on wholesale funding. Since the crisis, financial authorities worldwide have been in the process of implementing intensified liquidity regulations such as the liquidity coverage ratio and the net stable funding ratio in order to protect future liquidity shocks.

Before the crisis, the development of an interbank money market allowed banks to expand their borrowing of short-term wholesale funds to supplement retail deposits [Feldman et al. (2001), Huang and Ratnovski (2011)]. Wholesale funds are usually raised on a short-term rollover basis using financial instruments such as Fed funds, brokered deposits, and repurchase agreements.

Such wholesale funding has been more feasible for large banks that have high credit ratings and a generally low level of counterparty risk compared to small banks. A bank's composition of funding and its capability to borrow in wholesale capital markets are also seen as signals of bank creditworthiness to current and potential depositors. In fact, larger and fast-growing banks tend to have greater reliance on wholesale funding [Demirgüç-Kunt and Huizinga (2010)]. On the other hand, small banks have a funding structure that relies primarily on retail deposits. In other words, they have funding constraints on wholesale funds compared to large banks.

In the first chapter, I conjectured that small banks' funding constraints may reduce the negative effects of high loan growth on bank performance. The results from that chapter indicates that banks with relatively high loan growth experience subsequent harmful performance but the degree of such damage is less severe for small banks. The hypothesis that the better results of small banks could be caused by their funding constraints is plausible,

but not empirically verified [1].

In this paper, I investigate if the funding constraints of small banks are crucial to bank performance conditional on loan growth. As the first step, I examine the relationship between access to wholesale funds and loan growth for small and large banks. The second step is to examine the relationship between access to wholesale funds and bank performance conditional on loan growth. The final step is to compare the results of small banks with those of large banks as a benchmark. If access to wholesale funds is positively related to loan growth and small banks with access to wholesale funds have similar performance to large banks given loan growth, this suggests that the financial constraints play a critical role in lending and subsequent performance.

I estimate panel regressions with time and bank fixed effects in order to test if the small banks' constraints in access to wholesale funds matter. For the test, I employ the ratio of wholesale funding to retail deposits to measure access to wholesale funds following Choi and Choi (2017). Also, returns on assets (ROA) and nonperforming loans (NPL) to assets are used as the accounting measures for bank performance. The data set for the estimation consists of U.S. banks during 1992-2006 because the quarter-bank data is available and it is not affected by the recent crisis.

I first examine the relationship between the ratio of wholesale funding to retail deposits and credit growth for small and large banks. I find that a higher proportion of wholesale funding leads to higher loan growth. In detail, the ratio of wholesale funding has a positive relation to loan growth regardless of bank size. However, the large banks' wholesale funding ratio has a relatively high correlation with loan growth in comparison with small banks.

Next, I investigate the relationship between the wholesale funding ratio and bank performance conditional on loan growth. The results indicate that a higher proportion of wholesale funding tends to decrease banks' ROA and increase the ratio of NPL to assets conditional on loan growth. Lastly, I compare the results from small banks with those of large banks. The small banks' relationship between ROA and the proportion of wholesale funds is overall

[1] There may be another hypothesis. Ellul and Yerramilli (2013) find evidence that banks with stronger and more independent risk management can reduce tail risk exposures. This suggests that a risk management function could be a factor that explains the differences in lending behavior.

similar to that in the large banks given the same loan growth quartile. The case of the NPL ratio shows qualitatively similar results over time.

The empirical findings suggest that the differences in loan growth as well as subsequent performance between small and large banks are in part driven by the financial constraints. The evidence indicates that when small banks have access to wholesale funding, their lending behavior and related bank performance are similar to large banks. In other words, if there is no financial constraint on small banks, they might be vulnerable to fast loan growth like large banks.

My paper fills a gap in the literature because there is no previous work that focuses on wholesale funding constraints of small banks and their effects on lending behavior and related performance. Recent studies about banks' wholesale funding mainly have shed light on the risks of excessive reliance on short-term wholesale fund since the recent financial crisis [Demirgüç-Kunt and Huizinga (2010), Huang and Ratnovski (2011), Gorton and Metrick (2012)]. In particular, Huang and Ratnovski (2011) provide a theoretical model of the dark side of relying on wholesale funding in the sense that wholesale financiers could have an incentive to suddenly withdraw funding based on noisy signals of bank asset quality. Demirgüç-Kunt and Huizinga (2010) also point out that banking strategies attracting nondeposit funding combined with relying on noninterest income are very risky. In addition, there are several studies that focus on the effects of deposit market competition on banks' funding [Craig and Dinger (2013)] and the impacts of monetary policy on banks' funding composition [Choi and Choi (2017), Drechsler et al. (2017)].

In summary, I contribute to the literature in this area by analyzing the relation between access to wholesale funds and bank performance given loan growth, and finding a crucial role of financial constraints in smaller banks. My results have policy implications for the debate on the composition of bank funding. The financial authorities need to prudently monitor banks' funding side as well as their asset side.

The paper is structured as follows. Section 3.1 describes the data used in my analysis. Section 3.2 introduces the regression methodology and presents evidence on the correlates of the proportion of wholesale funding and credit growth as well as subsequent performance

conditional on credit growth. Section 3.3 concludes by discussing the implication of my results. I also provide the last section, which reports additional details regarding data and results of the estimations.

3.1 Data

3.1.1 Sample Construction

I collect quarterly data from the Federal Reserve's Report of Condition and Income ("Call Reports") in order to construct bank-quarter variables. The sample period begins in March 1992, and ends in December 2006 before the liquidity shock of the global financial crisis. The data are divided into small and large banks in order to compare the possible different effects of funding constraints. To distinguish small from large banks, I use $2 billion in total assets as a cutoff following Fahlenbrach et al. (2017).

The main variables for measuring access to wholesale funds are those used in Choi and Choi (2017). "Retail Deposits (RD)" is the amount of retail deposit funding, calculated by subtracting wholesale deposits (brokered deposits, foreign deposits, and the time deposits over $100,000) from total deposits. "Wholesale Funding (WSF)" is the sum of wholesale deposits, federal funds and repo borrowing, and other borrowed money.

The other independent variables are as follows. "Capital Ratio" is the ratio of total equity capital to total assets. "Returns on Assets (ROA)" is the ratio of net income to total assets. "Nonperforming Loans (NPL)" is the sum of total loans past due 30 through 89 days and still accruing as well as past due 90 days or more still accruing, and nonaccrual. "Funding Cost to Total Liabilities" is calculated as total interest expense to total liabilities. "Liquidity Assets" is the sum of total cash and balances due from depository institutions, federal funds sold and securities purchased under agreement to re-sell, and securities available for sale. Lastly, "Log Assets" is calculated as the natural log of bank's total assets measured in thousands of constant 2000 dollars. I winsorize all variables at the 5^{th} and 95^{th} percentile, by quarter.

3.1.2 Summary Statistics

Table 3.1 and 3.2 report summary statistics of variables in my analysis, with statistics for small banks shown in Table 3.1 and statistics for large banks shown in Table 3.2. The ratio of wholesale funding to retail deposits has a median of 14.36% and a standard deviation of 15.92% for small banks. Those statistics for large banks are larger. The ratio in the large banks has a median of 22.49% and a standard deviation of 20.32%. These imply that the large banks have a higher proportion of the wholesale funding and suggest that they have easier access to wholesale funds than small banks.

Also reported are the quarterly growth rates of retail and wholesale funding expressed as percentage changes. The percentage change in retail deposits of the small banks has a median of 1.03% and a standard deviation of 5.44%. That in the large banks has a smaller median value of 0.91% but a larger standard deviation of 6.19%. The percentage change in wholesale funding presents a different phenomenon in comparison with that in retail deposits. While the growth in wholesale funding of the small banks has a median of 1.57% and a standard deviation of 18.83%, that of the large banks has a median of 2.01% and a standard deviation of 21.78%. The quarterly change in the wholesale funding is larger and more volatile than that in the retail deposits, especially for the large banks.

Other variables are the quarter-to-quarter loan growth and the performance variables such as ROA and NPL. A median loan growth of the small banks (2.01%) is slightly higher than that of the large banks (1.81%). However, a median standard deviation of the small banks (5.42%) is close to half the standard deviation of the large banks (10.21%). With respect to the performance, the large banks have higher average returns per asset and higher average losses per loan than the small banks. ROA in the small banks has a median of 0.59% and that in the large banks has a median of 0.67%. A median NPL to total loans in the small banks (1.00%) is also lower than that in large banks (1.14%).

In addition to the bank and time fixed effects, I include the bank-level characteristics in my analysis. The small banks have, on average, a slightly higher capital ratio (9.44%) compared to the large banks (8.22%). In terms of the ratio of funding cost to total liabilities,

the small banks (1.78%) also have a slightly higher ratio than the large banks (1.73%). The median proportion of liquid assets in the small banks (17.80%) is much larger than that in the large banks (8.43%). The above numbers are derived from the variables that are winsorized at the 5% and 95% levels, by quarter.

3.2 Empirical Results

3.2.1 Regression Methodology

My first goal of the paper is to examine the relation between access to wholesale funds and loan growth at the individual bank level. The estimation approach follows a panel regression with fixed effects model by Kupiec et al. (2017).

$$LGR_{i,t} = \alpha_i + \beta_1 \times WSF/RD_{i,t-1} + \sum_{k=2}^{4} \beta_k \times X_{ki,t-1} + \beta_5 \times FC_{i,t} + \delta_t + \varepsilon_{i,t} \qquad (5)$$

where $LGR_{i,t}$ is the quarter-to-quarter loan growth of bank i in quarter t, $WSF/RD_{i,t-1}$ is the percentage ratio of wholesale funding to retail deposits of bank i in quarter $t-1$, $X_{k,t-1}$ denote bank-specific measures that affect loan growth of bank i in $t-1$ (capital ratio, liquid asset ratio, and log of total assets), $FC_{i,t}$ denotes bank i's ratio of funding costs to total liabilities in t, α_i and δ_t indicate bank-fixed effects and time-fixed effects, respectively.

In order to investigate if wholesale funding constraints matter for small banks, I test how access to wholesale funds is correlated to bank performance conditional on loan growth. The regression equation for this is as follows.

$$r_{i,t+k} = \alpha_i + \sum_{k=1}^{4} \beta_k \times WSF/RD_{i,t} \times I_{l_{i,t} \in Q_{k,t}} + \delta_t + \varepsilon_{i,t} \qquad (6)$$

where $r_{i,t+k}$ is the k-quarter ahead ROA or the ratio of NPL to total loans of bank i, $l_{i,t}$ is the quarter-to-quarter loan growth of bank i in quarter t, $Q_{k,t}$ is k^{th} loan growth quartile of all sample banks in quarter t, $I_{l_{i,t} \in Q_{k,t}}$ is an indicator variable equal to 1 if $l_{i,t}$ is in the $Q_{k,t}$

in quarter t, and zero otherwise. In this estimation, the main four independent variables are the products of wholesale funding ratio and the dummy variable that is assigned to each loan growth quartile. I run regressions for subsequent 2-quarter to 8-quarter ROA and NPL ratio. These independent variables can explain, conditional on loan growth, how much an increase in wholesale funding ratio raises subsequent bank performance through the specification (6).

3.2.2 Wholesale Funding and Loan Growth

In this section, I compare the relation between access to wholesale funds and loan growth among small and large banks. I estimate the panel regressions with fixed effects specified in the equation (5). Table 3.3 reports the regression results of quarter-to-quarter loan growth on the ratio of wholesale funding to retail deposits.

The first column (Small) reports the regression result for the small banks. The one-quarter lag of the ratio of wholesale funding to retail deposits is the main independent variable. The effect of the ratio is 0.009, with a t-statistic of 12.30. An increase in the ratio augments the banks' loan growth and this relation is statistically significant. In terms of economic significance, a 1 standard deviation increase in the ratio will raise 0.14% of the loan growth in the small banks.

The second column (Large) reports the regression result for the large banks. I find that a 1% increase in the ratio of wholesale funding to retail deposits is associated with a 0.03% increase in loan growth for large banks. This relation is statistically significant. It is also economically significant given that a 1 standard deviation increase in the ratio will augment 0.43% of the loan growth in the large banks.

In addition, I estimate the regression replacing the ratio of wholesale funding to retail deposits by a percentage change in wholesale funding and a percentage change in retail deposits. Table 3.4 reports the regression results.

The first column (Small) reports the regression result for small banks. The one-quarter lag of the percentage change in wholesale funding has significantly positive relation to the loan growth (coefficient: 0.015). The percentage change in retail deposits also has a similar

relationship, but that in the retail deposits has a greater impact on the loan growth (coefficient: 0.07).

The second column (Large) of Table 3.4 shows that the results from the large banks are qualitatively similar to those of the small banks. Both factors' effects on loan growth are greater for small banks than those for large banks (coefficient: wholesale funding 0.008, retail deposits 0.032). Also, the relative impact of a change in retail deposits is greater for small banks than for large banks.

In summary, the ratio of wholesale funding to retail deposits has a positive relation to loan growth regardless of bank size. However, the large banks' wholesale funding ratio has a relatively high correlation with their loan growth in comparison with the small banks.

3.2.3 Wholesale Funding and Bank Performance

I next examine the relation between access to wholesale funds and credit performance conditional on loan growth. I estimate the panel regressions with fixed effects specified in the equation (6). In particular, I focus on investigating if the small banks with access to finance conditional on credit growth have similar performance to the large banks. If there is such evidence, this suggests that financial constraints play an important role.

Table 3.5 shows how the effects of wholesale funding to retail deposits on ROA change over time. The small banks' wholesale funding ratio in every quartile of loan growth becomes more negatively correlated with ROA over time. For instance, the coefficient of the wholesale funding ratio on ROA increases from -0.0011 in two quarters to -0.0042 in eight quarters among the set of small banks in the lowest loan growth quartile. The large banks have a qualitatively similar tendency. The magnitude of the coefficients of the main four variables is also slightly different between the small and large banks from one year after the formation period.

Table 3.6 also reports how the effect of wholesale funding ratio on the NPL to total loans change over time. The small banks' wholesale funding ratio in every quartile of loan growth has a significantly positive correlation with the ratio of NPL and the degree of correlation

expands over time except the case of fourth quartile after two quarters. For instance, the positive correlation between the wholesale funding ratio and the NPL ratio increases from -0.0007 in the second quarter to 0.0072 in the eighth quarter among the set of the small banks in the highest loan growth quartile. The large banks have qualitatively a similar tendency like the case of ROA.

However, there is a difference in the results between ROA and the NPL ratio. Regarding the NPL ratio, the coefficients of all variables for the small banks are much greater than those for the large banks. In other words, a higher wholesale funding ratio leads to larger proportion of the loans with high default risk for the small banks.

Taken together, conditional on loan growth, a higher proportion of wholesale funding tends to decrease banks' returns but increase banks' losses. In particular, the small banks' relationship between access to wholesale funds and ROA is similar to that for the large banks given the same loan growth quartile. The case of the NPL ratio also shows qualitatively similar results over time. However, as the proportion of the wholesale funding increases, the degree of the deterioration of credit soundness conditional on loan growth is more severe for the small banks over time.

3.3 Discussion and Conclusion

The recent financial crisis has led to greater concern over a bank's funding composition, especially its wholesale funding. The existing literature mostly focuses on the danger of excessive reliance on wholesale funding and its impact on monetary policy. Instead, this paper investigates the effects of funding constraints on small banks' credit growth and subsequent performance.

The main contribution of this paper is to provide evidence on a crucial role of financial constraints in smaller banks. Specifically, higher access to wholesale funds tends to induce higher credit growth and lower performance conditional on credit growth. The findings imply that when smaller banks have access to wholesale funding, they are likely to carry out lending behavior and related bank performance that is similar to large banks.

In future research, it would be interesting to find other reasons for differences in lending behavior and subsequent performance between small and large banks. Ellul and Yerramilli (2013) suggest that banks' risk management function can be a crucial factor affecting lending behavior and subsequent performance. They focus on the 72 largest bank holding companies in the U.S for their analysis. Therefore, it would be meaningful if one can explain the differences in lending behavior between small and large banks by examining internal controls and risk management of both bank groups. This task is left for future research.

3.4 Tables

3.4.1 Sample

I construct a panel data set with quarterly observations over 1992-2006 from Call Reports. The data are divided into small and large banks, where $2 billion in total assets is used as a cutoff following Fahlenbrach et al. (2017). Main variables for measuring access to wholesale funds are those used in Choi and Choi (2017). "Retail Deposits (RD)" is the amount of retail deposit funding, calculated by subtracting wholesale deposits (brokered deposits, foreign deposits, and the time deposits over $100,000) from total deposits. "Wholesale Funding (WSF)" is the sum of wholesale deposits, federal funds and repo borrowing, and other borrowed money. The other independent variables are as follows. "Capital Ratio" is the ratio of total equity capital to total assets. "Returns on Assets (ROA)" is the ratio of net income to total assets. "Nonperforming Loans (NPL) to Total Loans" is calculated as the sum of total loans past due 30 through 89 days and still accruing as well as past due 90 days or more still accruing, and nonaccrual divided by total loans. "Funding Cost to Total Liabilities" is calculated as total interest expense divided total liabilities. "Liquidity Assets to Assets" is calculated as the sum of total cash and balances due from depository institutions, federal funds sold and securities purchased under agreement to re-sell, and securities available for sale divided by total assets. Lastly, "Log Assets" is calculated as the natural log of bank's total assets measured in thousands of constant 2000 dollars. I winsorize all variables at the 5^{th} and 95^{th} percentile, by quarter. All statistics are pooled across banks and time.

Table 3.1: Summary statistics: small banks

Variable Name	obs.	Mean	St.Dev	Min.	25th pec.	Median	75th pec.	Max.
Loan Growth (quarter-to-quarter, %)	586,882	2.612	5.419	-10.551	-0.738	2.007	5.195	21.644
Wholesale Funding to Retail Deposits (%)	585,465	18.739	15.916	1.470	8.215	14.363	23.984	118.923
Change in Retail Deposits (%)	570,892	1.797	5.437	-10.691	-1.584	1.026	4.218	29.830
Change in Wholesale Funding (%)	578,640	4.772	18.832	-50.922	-5.182	1.573	11.622	84.911
Captial Ratio (%)	589,309	10.377	3.360	5.367	8.032	9.443	11.726	27.002
Return on Assets (%)	587,772	0.667	0.487	-1.462	0.310	0.592	0.977	2.381
Nonperforming Loans to Total Loans (%)	588,509	1.542	1.617	0.000	0.334	1.000	2.220	8.078
Funding Cost to Total Liabilities (%)	587,500	1.919	1.060	0.171	0.995	1.784	2.685	4.904
Liquidity Assets to Assets (%)	605,889	20.159	14.012	1.570	7.566	17.803	29.570	55.118
Total Assets (million dollars as 2000)	609,789	143	163	13	38	78	170	759

Table 3.2: Summary statistics: large Banks

Variable Name	obs.	Mean	St.Dev	Min.	25th pec.	Median	75th pec.	Max.
Loan Growth (quarter-to-quarter, %)	22,358	3.252	10.208	-22.386	-1.343	1.809	5.567	66.645
Wholesale Funding to Retail Deposits (%)	17,454	27.001	20.323	1.470	11.800	22.492	36.730	118.923
Change in Retail Deposits (%)	17,125	2.028	6.194	-10.691	-1.726	0.910	4.476	29.830
Change in Wholesale Funding (%)	22,065	4.975	21.779	-50.922	-8.029	2.012	14.589	84.911
Captial Ratio (%)	17,718	9.253	3.643	4.379	7.015	8.216	10.057	27.672
Return on Assets (%)	17,655	0.774	0.551	-0.515	0.355	0.672	1.050	3.444
Nonperforming Loans to Total Loans (%)	19,433	1.586	1.486	0.000	0.609	1.140	2.040	10.400
Funding Cost to Total Liabilities (%)	17,655	1.894	1.108	0.137	0.958	1.729	2.663	5.511
Liquidity Assets to Assets (%)	22,598	13.535	12.600	0.191	3.671	8.425	21.065	56.387
Total Assets (milion dollar as 2000)	23,024	11,300	14,500	2,093	3,006	5,307	11,900	103,000

3.4.2 Tables of Results

Wholesale Funding/Retail Deposits and Loan Growth

The table reports estimates from the panel regression with fixed effects specified in the equation (5) for the quarter-to-quarter loan growth. I divide all banks into two bank groups such as small and large banks and then estimate regressions for both bank groups, respectively. The four independent variables except "Funding Cost to Assets" include one-quarter lag $(t-1)$ following Kupiec et al. (2017). Numbers in parentheses are t-statistics. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

Table 3.3: Wholesale funding to retail deposits and loan growth

	Loan Growth Rate (quarter-to-quarter, t)	
	Small	Large
Wholesale Funding to Retail Deposits (%, t-1)	0.0093*** (13.19)	0.0270*** (5.36)
Captial Ratio (%, t-1)	0.1961*** (50.99)	-0.1272*** (-3.84)
Funding Cost to Total Liabilities (%, t)	-2.4240*** (-98.72)	-3.1890*** (-16.09)
Liquidity Assets to Assets (%, t-1)	0.0268*** (33.63)	0.0244*** (2.76)
Log Assets (t-1)	-0.9716*** (-38.75)	-2.7015*** (-12.47)
# of observations	567,827	16,506
R-squared	0.105	0.066

The following table also report the panel regression estimates from the equation (5) for the quarter-to-quarter loan growth. The ratio of wholesale funding to retail deposits is replaced by the two variables such as change in wholesale funding and change in retail deposits. The other conditions related to the following results are identical to those of the previous table. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Table 3.4: Change in funding and loan growth

	Loan Growth Rate (quarter-to-quarter, t)	
	Small	Large
Change in Wholesale Funding (%, t-1)	0.0148***	0.0081***
	(43.29)	(2.61)
Change in Retail Deposits (%, t-1)	0.0688***	0.0331***
	(54.08)	(3.25)
Captial Ratio (%, t-1)	0.1860***	-0.1192***
	(47.30)	(-3.55)
Funding Cost to Total Liabilities (%, t)	-2.1745***	-3.007***
	(-87.29)	(-14.99)
Liquidity Assets to Assets (%, t-1)	0.0282***	0.0219**
	(34.84)	(2.48)
Log Assets (t-1)	-0.8372***	-2.6802***
	(-34.15)	(-12.23)
# of observations	549,036	16,062
R-squared	0.108	0.066

Wholesale Funding/Retail Deposits and Bank Performance

The tables report the panel regression estimates specified in the equation (6) for ROA and NPL conditional on loan growth in subsequent two to eight quarters. I estimate regressions for both small and large banks, respectively. The main four independent variables are the products of wholesale funding ratio and the dummy variable that is assigned to each loan growth quartile. If a bank's loan growth is in the lowest quartile, "Loan Growth Quartile Dummy 1" is equal to 1 and zero otherwise. Numbers in parentheses are t-statistics. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively.

Table 3.5: Wholesale funding to retail deposits and ROA conditional on loan growth

	ROA_{t+2}		ROA_{t+4}		ROA_{t+6}		ROA_{t+8}	
	Small	Large	Small	Large	Small	Large	Small	Large
Wholesale Funding to Retail Deposits (%) × Loan Growth Quartile 1 Dummy	-0.0011*** (-21.69)	-0.0018*** (-6.80)	-0.0023*** (-44.86)	-0.0025*** (-8.07)	-0.0027*** (-46.85)	-0.0028*** (-8.19)	-0.0042*** (-62.93)	-0.0035*** (-8.00)
Wholesale Funding to Retail Deposits (%) × Loan Growth Quartile 2 Dummy	0.0001 (1.03)	-0.0014*** (-5.46)	-0.0014*** (-24.42)	-0.0021*** (-7.11)	-0.0019*** (-32.55)	-0.0023*** (-7.16)	-0.0034*** (-51.87)	-0.0031*** (-7.60)
Wholesale Funding to Retail Deposits (%) × Loan Growth Quartile 3 Dummy	0.0005*** (10.05)	-0.0009*** (-3.96)	-0.0009*** (-16.55)	-0.0012*** (-4.32)	-0.0016*** (-28.64)	-0.0017*** (-5.58)	-0.0032*** (-50.87)	-0.0024*** (-6.13)
Wholesale Funding to Retail Deposits (%) × Loan Growth Quartile 4 Dummy	-0.0003*** (-5.99)	-0.0011*** (-4.64)	-0.0012*** (-23.50)	-0.0006** (-2.22)	-0.0016*** (-29.93)	-0.0016*** (-5.16)	-0.0031*** (-51.47)	-0.0013*** (-3.34)
# of obs.	554,174	16,151	540,573	15,360	527,315	14,613	514,389	13,892
R-squared	0.523	0.560	0.486	0.500	0.502	0.499	0.445	0.428

Table 3.6: Wholesale funding to retail deposits and NPL conditional on loan growth

	NPL_{t+2}		NPL_{t+4}		NPL_{t+6}		NPL_{t+8}	
	Small	Large	Small	Large	Small	Large	Small	Large
Wholesale Funding to Retail Deposits (%) × Loan Growth Quartile 1 Dummy	0.0135*** (60.87)	0.0032*** (4.78)	0.0143*** (60.55)	0.0030*** (4.34)	0.0132*** (51.31)	0.0013* (1.79)	0.0130*** (46.27)	0.0019** (2.40)
Wholesale Funding to Retail Deposits (%) × Loan Growth Quartile 2 Dummy	0.0077*** (34.98)	-0.0002 (-0.25)	0.0094*** (40.18)	0.0017*** (2.66)	0.0106*** (41.77)	0.0017** (2.47)	0.0112*** (40.48)	0.0011 (1.51)
Wholesale Funding to Retail Deposits (%) × Loan Growth Quartile 3 Dummy	0.0032*** (15.41)	-0.0034*** (-5.58)	0.0058*** (26.15)	-0.0014** (-2.27)	0.0081*** (33.41)	-0.0011* (-1.65)	0.0094*** (35.29)	-0.0009 (-1.25)
Wholesale Funding to Retail Deposits (%) × Loan Growth Quartile 4 Dummy	-0.0007*** (-3.55)	-0.0044*** (-7.16)	0.0025*** (11.86)	-0.0020*** (-3.21)	0.0054*** (23.17)	-0.0001 (-0.17)	0.0072*** (28.30)	0.0007 (0.95)
# of obs.	540,041	15,680	512,235	14,409	485,215	13,214	459,033	12,087
R-squared	0.244	0.341	0.250	0.333	0.255	0.330	0.261	0.341

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